UNIVERSITY OF TORONTO LIBRARY

Edinburgh Medical Journal

Edinburgh Medical Journal

With which is Incorporated the
Scottish Medical and Surgical Journal

EDITED BY

ALEXANDER MILES AND J. S. FOWLER

January to June 1922

(NEW SERIES)—VOLUME XXVIII
[Ser. 3]

17772
11/A/22

Edinburgh
Published for the Proprietors by
Oliver and Boyd, Tweeddale Court
London: 33 Paternoster Row
1922

R
31
E22
ser. 3
v. 28-29

Edinburgh Medical Journal

January 1922

EDITORIAL NOTES

A New Feature of the Journal.

In this issue of the Journal we commence the serial publication of the Transactions of the Medico-Chirurgical Society of Edinburgh and of the Edinburgh Obstetrical Society. Month by month our subscribers, including the members of the Societies, will receive with the Journal an instalment of the proceedings of each Society.

To admit of the series of "Transactions" that have been issued by both these Societies over a long period of years being uninterrupted, arrangements have been made by which the sections of the Journal devoted to the proceedings of each Society can be detached and bound as a separate volume at the end of each year. For this purpose a separate title-page and other preliminary matter, together with an index, will be provided to the members of each Society, and we shall supply at the current market price a cloth case for binding the "Transactions" uniform with the preceding volumes.

Every effort will be made to secure that monthly instalments include a complete report of the transactions of each meeting, but it may be well to point out to our readers that, for technical reasons, the provision made for binding may occasionally involve part of the proceedings of a meeting being carried over to the next number of the Journal.

The late Dr William Paterson of Leith.

It is with deep regret we record the death of Dr William Paterson of Leith on 13th November last. Born and brought up as so many of the doctors and ministers in Scotland have been in a rural parish (his parents resided at Carnwath, in the Upper Ward of Lanarkshire), he finished his school education in Edinburgh, and entered an Insurance Office to begin a business life. A little later, however, he was

appointed agent at Durban for a business firm and went out to Natal.

Those who came in contact with him in later life knew how much the memory of his life in South Africa broadened his views and occasionally tinged his conversation.

Being brought up in a typically Scottish Christian home, he had in his early life leanings towards the ministry, but on account of his health at the time had reluctantly given the idea up. Whilst in South Africa he determined to become a doctor, and came home to study for his degree at Edinburgh University. Graduating M.B., C.M. in 1887 he soon settled in Leith where some of his relatives resided.

He had not been long in practice before he gathered around him a large clientele amongst all classes of the community, and his devotion to his work and his sound medical knowledge and skill fostered in his patients a confidence, a faith, and a loyalty to which few doctors can attain. For about thirty-two years he toiled and laboured amongst them, and his visits to those in trouble were ever longed for and welcome. It was his privilege to die at his post as probably he would have wished, for he carried on his work till a few days before his death from pneumonia.

To his medical brethren of Leith and Edinburgh Dr Paterson was well known as one of the best types of family physician, a man with a kindly, sympathetic manner, a well-trained and highly experienced medical mind, with a conscientious realisation of the responsibilities of his calling and of the importance of every detail of his work. Being a busy man he had little time to take an active interest in public or other affairs outside his profession, but his intimate friends know how much social and religious questions occupied his spare moments, and how closely he followed the progress of the various social discussions and movements of the times. Music was his most constant relaxation after work, while Art and, above all, Nature were ever a joy.

The large number of his fellow citizens who followed his remains to the cemetery was a fitting testimony to the place he held in the estimation of his own profession and of the community as a whole.

He leaves a widow and three of a family (two sons and a daughter), to whom the sympathy of his medical brethren is extended in the loss of an ideal husband and father.—W. E.

Royal College of Physicians of Edinburgh.

At the Annual Meeting of the Royal College of Physicians of Edinburgh held on 1st December 1921, Sir Robert Philip, M.D., LL.D., was elected President for the ensuing year. The other office-bearers for the year were appointed as follows:—Vice-President,

Dr Harry Rainy; Councillors, Drs John W. Ballantyne, John Macpherson, George M. Robertson, Robert Thin, and James Lamond Lackie; Treasurer, Dr Norman Walker; Secretary, Dr J. S. Fowler; Hon. Librarian, Dr John William Ballantyne; Curator of the Research Laboratory, Dr J. J. Graham Brown.

Post-Graduate Demonstrations.

A SERIES of Clinical Demonstrations and Lectures will be given in the Royal Hospital for Sick Children on Thursday afternoons at 5 P.M., beginning on 19th January. These are open to all medical practitioners. The subjects are as follows:—19th January, The Acute Abdomen in Childhood. 26th January, The Varieties and Treatment of Pyuria. 2nd February, Causes of Wasting in Young Children. 9th February, Orthopædics in Infancy. 16th February, Infant Feeding. 23rd February, Certain Habits and Minor Neuroses in Children. 2nd March, Modern Methods of Treatment of Bone and Joint Tuberculosis. 9th March, Fibrosis of the Lung in Children. 16th March, Acetonæmia. 23rd March, Middle-ear Suppuration in Childhood.

BASAL METABOLIC RATE: ITS DETERMINATION AND CLINICAL SIGNIFICANCE.

By JONATHAN MEAKINS, M.D., F.R.C.P.E., and H. WHITRIDGE DAVIES, M.B.

(*From the Department of Therapeutics, University of Edinburgh.*)

Introductory.—The determination of the basal metabolic rate (B.M.R.) has recently taken a prominent place among exact methods of clinical investigation. In America a great deal has been done by Benedict[8] and by Boothby, and their associates. The work of the former has been in the comparison of methods and in the establishment of normal standards, while that of the latter has been in its clinical application. While we are not disposed to admit its unique importance as certain observers do, we appreciate its great value in certain cases, especially in those of disordered function of the thyroid and pituitary glands, where it may be useful both in diagnosis and in giving an accurate quantitative index of progress and of the effects of treatment.

Definition.—The basal metabolic rate is the rate of energy exchange, *i.e.*, calories per unit of time and per unit of body surface, under basal conditions. By basal conditions are meant the elimination of movement and the utmost possible elimination of digestion and nervous excitement, leaving only the essential vital processes—respiration, circulation, glandular activity, and muscular tonus. The result is conveniently expressed as percentage increase or decrease, as compared with the known standard for the average normal individual of the same sex and age as the subject.

In order to eliminate or reduce to a constant minimum, the energy expended during the active processes of digestion and assimilation of food, the determinations are made while the subject is in the "post-absorptive condition," that is to say, at least twelve hours after the last meal. For this reason determinations can most conveniently be made between 8.30 and 9 a.m., the subject being without breakfast until after the determination has been made. This gives the true basal metabolic rate as distinct from the post-prandial metabolic rate, which is somewhat higher.

The other essentials are complete rest in the recumbent position on a comfortable bed or couch for at least thirty

minutes before and also during the determination, which must be made in a room where there is no noise or disturbance of any kind. Nervous apprehension and excitement on the part of the subject can be avoided by a simple explanation of what is to be done. If in spite of this the patient still exhibits signs of nervousness, a not infrequent occurrence in cases of hyperthyroidism, the result of the first determination must be disregarded, and a further determination made on a subsequent day when experience will have shown that there is no cause for apprehension. Immediately prior to the preliminary rest-period the subject's height (cms.) and weight (kilos) are carefully determined, deducting from the latter the weight of the clothing which the subject may be wearing at the time. Fever causes a marked and variable increase in the metabolic rate, and it is essential that the subject should be a-febrile not only during the determination but also for at least twenty-four hours previously.

Methods. (I.) *Direct Calorimetry.*—This consists in determining directly the energy expenditure by means of a large bed calorimeter. It is obvious that this method requires complicated and expensive apparatus, elaborate technique, and is unsuited for clinical investigations. Further, the results for short periods are less accurate than those given by the indirect method.

(II.) *Indirect Calorimetry.*—This consists in measuring the oxygen consumption of the subject during an accurately timed period. As each litre of oxygen consumed represents a definite number of calories one can find by a simple arithmetical calculation the number of calories during a stated unit of time. This can be done in two different ways :—

(A) The re-breathing of oxygen or air enriched with oxygen in a "closed circuit" apparatus with an arrangement for the absorption of the carbon dioxide exhaled. The oxygen used by the patient is directly shown by the diminution in volume of the gas in the apparatus. This is the method used by Benedict. A somewhat similar method was described by Prof. Krogh of Copenhagen at the physiological section of the Edinburgh Meeting of the British Association. Oxygen re-breathing also constitutes the general principle of several methods at present much in use. We have no practical experience of these methods, but theoretically there are several fundamental objections, both mechanical and physiological. In normal individuals the oxygen consumption is of the order of about 300 c.c. per minute, and a discrepancy of this amount

or possibly more may occur according to the precise phase of respiration at which the subject commences and ceases to breathe in and out of the apparatus. In an observation extending over five minutes this discrepancy would give rise to a possible error of ± 20 per cent. This criticism, however, does not apply to Prof. Krogh's method.

Types of apparatus have recently been described where the B.M.R. can be read off almost directly. Those who advocate them lay stress upon the absence of calculations and avoidance of the necessity for gas analysis, but this simplification involves neglect of the variations of temperature and barometer, a factor which may produce an error of from 5 to 8 per cent. The calorific value of oxygen (calories corresponding to one litre of oxygen consumed) is subject to slight variations which are known to correspond to variations of the respiratory quotient $\left(\text{Ratio} = \frac{\text{carbon dioxide eliminated}}{\text{oxygen consumed}}\right)$. In normal individuals in the post-absorptive condition these variations are insignificant. The respiratory quotient cannot be determined in the re-breathing methods, and therefore a fixed calorific value for oxygen is taken. We have found, however, that in pathological cases there may be variations in the respiratory quotient which may cause differences amounting to as much as 5 per cent. in the calorific value of oxygen. Finally, the re-breathing of pure oxygen is scarcely a normal circumstance. Dautrebande and Haldane[3] have recently shown that it produced definite changes in respiration and circulation, the latter being slowed and the pulse rate diminished by from five to eight beats per minute. All these objections depend upon simple physical and physiological principles. The fact that duplicate determinations may chance to agree, or that a determination may give a result agreeing with that of a more accurate method, produces a false idea of their reliability, for the possible error may be as much as ± 30 per cent.

(B) Collection and analysis of the patient's expired air. This is the principle of the Douglas and also of Boothby's methods. The only difference in the two methods is the type of mask and the receptacle used for the collection of the expired air. Boothby[1] uses the Tissot mask and a spirometer. By using the spirometer it is usually necessary to take the patient from familiar surroundings, thus tending to magnify the importance of the procedure and to induce apprehension.

By the use of the Douglas bag the expired air may be collected in the patient's ordinary surroundings whether in the home or the hospital. The general disadvantage of either the Douglas bag or the spirometer method is that they require a certain amount of skill and care in the technique of gas analysis.

We have modified and adapted the Douglas bag method after the following manner:—

The apparatus required for the collection of expired air consists of a suitable face mask, a length of about 1½ metres of flexible non-collapsible rubber tubing, about 1¼ inches diameter, leading from the mask to the three-way tap of the bag and a Douglas bag capable of holding about 100 litres. The tap is so arranged that the expired air may be directed either into the room or into the bag at will. The mask employed is an ordinary Haldane oxygen administration mask modified by the attachment of valves so arranged that inspiration is from the room air and expiration into the tube leading to the bag. After experimenting with many different arrangements one of us (J. C. M.) found this type to be the most suitable. It has been described in detail by Dautrebande and Davies,[2] who found that it causes a minimum of disturbance of respiration.

After the preliminaries described above, the mask is applied to the patient, care being taken to see that there are no leakages of expired air around the face-piece of the mask. This is done by blocking the outlet and requesting the patient to expire forcibly. If there be any leaks they will at once become apparent by this means, and the mask must be re-adjusted and tightly tied on with a bandage so that no leaks occur. The patient's pulse and respiration rate must be taken at frequent intervals before and during the determination, and any marked variations, due probably to nervousness or movement on the part of the patient, render the result less accurate. When the mask is adjusted the tap is turned so that the patient expires into the bag and about 20 litres of expired air are collected. The bag is then disconnected, its contents mixed and then expressed in order that the expired air sample may not be contaminated by the small amount of residual air remaining in the bag from previous determinations. The bag is then again connected up and a sample of expired air collected during an accurately timed period—usually ten minutes or more, after which the tap is closed, the bag disconnected

and taken with its contents to the laboratory for the subsequent measurement and analysis.

The volume of expired air is measured by means of a "wet" meter. The temperature of the meter and the barometric pressure at the time are noted. The number of litres of expired air from a ten-minute period multiplied by six gives the number of litres per hour. Knowing the temperature and barometric pressure one can obtain from a table given by Haldane[4] the factor for reducing the expired air to its dry volume at 0° C. and 760 mm. While the volume of the expired air is being measured, two samples for analysis are taken in Haldane gas-sampling tubes. These samples are analysed in the Haldane gas analysis apparatus for their carbon dioxide and oxygen percentages. From a comparison of the results with the oxygen and carbon dioxide of ordinary room air, the percentage of carbon dioxide eliminated and of oxygen absorbed can be calculated.

In calculating the percentage of oxygen taken up, it is obvious that simply to subtract the percentage in the expired air from that in atmospheric air would give a fallacious result. The volume of air inspired is greater than that expired on account of the fact that more oxygen is taken up than carbon dioxide given up. The one constituent of the respired air which remains constant in absolute amount during respiration is the nitrogen, and by finding the true percentage of oxygen corresponding to the amount of nitrogen in the expired air, and subtracting from the former the percentage of oxygen in the expired air, the true percentage of oxygen taken up from a given volume of expired air may be obtained. The normal constituents of atmospheric air are as follows—

Nitrogen (including argon, etc.) . .	79·04 per cent.
Oxygen	20·93 „
Carbon dioxide	0·03 „

If, then, we find that the expired air contains oxygen 17·35 per cent. and carbon dioxide 3·17 per cent., the sum of these subtracted from 100 is the percentage of nitrogen, 79·48 per cent. This latter multiplied by $\frac{20{\cdot}93}{79{\cdot}04}$ (*i.e.*, 0·2648) gives the percentage of oxygen in the inspired air corresponding to the amount of nitrogen in the expired air. This percentage of oxygen is found to be 21·05 per cent. in the present example. If from

this we subtract the percentage of oxygen in the expired air (17·35 per cent. in this instance) the result is the correct amount of oxygen taken up, 3·70 per cent.—or, to put it in another way, each litre of expired air represents an oxygen consumption of 37·0 c.c. of oxygen. This figure is very different from that obtained by subtracting 17·35 per cent. from 20·93 per cent. Moreover, if 3·70 be divided into 3·14 (carbon dioxide percentage of expired air less 0·03 per cent., the amount in the inspired air), the result is the respiratory quotient, 0·857. Zuntz and Schumburg[5] have prepared tables showing the number of calories corresponding to each litre of oxygen absorbed at varying respiratory quotients (Table I.). Aub and Du Bois

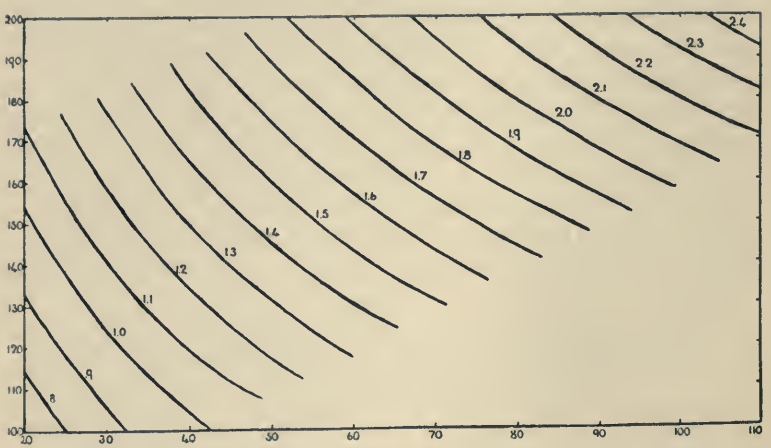
TABLE I.

Calorific Value of One Litre of Oxygen for Various (Non-Protein) Respiratory Quotients.

Respiratory Quotients.	Calories for 1 Litre of Oxygen.	Respiratory Quotients.	Calories for 1 Litre of Oxygen.
0·707	4·686	0·85	4·863
0·71	4·690	0·86	4·875
0·72	4·702	0·87	4·887
0·73	4·714	0·88	4·900
0·74	4·727	0·89	4·912
0·75	4·739	0·90	4·924
0·76	4·752	0·91	4·936
0·77	4·764	0·92	4·948
0·78	4·776	0·93	4·960
0·79	4·789	0·94	4·973
0·80	4·801	0·95	4·985
0·81	4·813	0·96	4·997
0·82	4·825	0·97	5·010
0·83	4·838	0·98	5·022
0·84	4·850	0·99	5·034
		1·00	5·047

have estimated the normal number of calories per square metre per hour for normal people of varying ages and of both sexes (Table II.). The surface area of the patient (square metres) can be read off directly from the Du Bois[7] height-weight chart (Fig. 1) which corresponds to the formula—Area (sq. cm.) $= \text{Weight}^{\cdot 435} \times \text{Height}^{\cdot 725} \times 71{\cdot}84$ (Fig. 1). Having obtained the above data the calculation is extremely simple. Litres of expired air per hour multiplied by factor for reducing to standard temperature and pressure, multiplied by percentage of oxygen taken up gives the number of litres of oxygen consumed per hour. This multiplied by the number of calories per litre of

oxygen gives the number of calories per hour, and the latter divided by the patient's surface area gives the number of



Ordinate = Height – cm.
Abscissa = Weight – kilograms.

FIG. 1.—Du Bois Height-weight Chart for determining the Surface Area of Man in Square Metres from Weight in Kilograms (Wt.) and Height in Centimetres (Ht.).

calories per hour per square metre. This is compared with the normal as published by Aub and Du Bois (Table II.) and the

TABLE II.

Standards of Normal Metabolism.

Average Calories per hour per square metre of Body Surface (Du Bois).

Age	Males.	Females.
Years.	Calories.	Calories.
14 to 16	46·0	43·0
16 „ 18	43·0	40·0
18 „ 20	41·0	38·0
20 „ 30	39·5	37·0
30 „ 40	39·5	36·5
40 „ 50	38·5	36·0
50 „ 60	37·5	35·0
60 „ 70	36·5	34·0
70 „ 80	35·5	33·0

difference expressed as a percentage of the normal. The following case will serve as an example:—

Basal Metabolic Rate

20/10/21.—M. B., female, aged 18. Partial thyroidectomy four weeks previously.

Height 60 ins. = 152.4 cms.
Weight 125 lbs. = 56.7 kilograms.
∴ Surface (Du Bois chart) = 1.53 square metres.

9.5	a.m.	Mask adjusted. Patient comfortable.
9.10	,,	Pulse 79. Respirations 24.
9.13	,,	,, 76. ,, 23.
9.14	,,	Period of collecting expired air commenced.
9.17	,,	Pulse 74. Respirations 23.
9.21	,,	,, 72. ,, 21.
9.24	,,	Period finished.

Expired air 82 litres × 6 = 492 litres per hour.

Temperature 16.6° C. Barometer 758. Therefore factor for reducing to dry volume at 0° C. and 760 mm. (Haldane table) is .923.

1st sample	CO_2 = 2.81 per cent.	O_2 = 17.60 per cent.
2nd ,,	,, = 2.85 ,,	,, = 17.62 ,,
mean	,, = 2.83 ,,	,, = 17.61 ,,

Therefore oxygen taken up is 3.46 per cent. Respiratory quotient 0.81.

Each litre of oxygen = 4.813 calories.

Therefore $492 \times .923 \times \frac{3.46}{100} \times 4.813 = 75.6$ calories per hour.

75.6 ÷ 1.53 = 49.4 calories per square metre per hour.

Normal for female, aged 18 = 39 calories per square metre per hour.

∴ Basal metabolic rate = $\frac{49.4 - 39}{39} \times 100 = +27$ per cent.

Should the number of calories be less than normal the difference is expressed as minus so many per cent. These long multiplication sums can be done very much more rapidly by the use of logarithms. The whole determination, collection of expired air, measurement, analysis, and calculation can be done in just under an hour. Theoretically the possible error with this method is less than 5 per cent., but in practice we have found that carefully made duplicate estimations upon the same normal individual give results which are absolutely identical. Certainly it gives results well within the limits of normal variation (± 10 per cent.) observed in healthy people.

Clinical Significance of Basal Metabolic Rate.

In order to appreciate the significance of variations of the B.M.R., it is necessary to review in brief the normal regulation of non-protein metabolism. As had been previously stated the basal metabolic rate is the rate of energy exchange, *i.e.*, calories per unit of time and per unit of body surface, under basal conditions. This presupposes the elimination of all accidental and outside factors which may vary the energy exchange of the body. These factors have already been dealt with and need not be repeated. It remains, however, to consider what regulates the rate and continuation of metabolism under basal conditions. Although the exact control of the energy balance of the body is not as yet clearly understood, it is known that certain organs may profoundly influence it. The most important of these are the ductless glands of which the thyroid appears to play the most prominent part. Indeed its influence appears to be so profound as almost to dominate the whole picture. If the thyroid function be increased there will be an increase in basal metabolic rate, while if its function be decreased there will be a corresponding diminution in B.M.R. Besides the thyroid, the ovaries and testes also play a part as was demonstrated by Loewy and Richter. They found that spayed bitches and castrated dogs showed a diminution of respiratory exchange amounting to 20 and 14 per cent. per kilogram of body-weight as compared with the normal condition. There is also a certain amount of evidence that changes in the pituitary gland may similarly influence metabolism. But the rôles of the ovaries, testes, and pituitary gland are relatively secondary to that of the thyroid.

Besides the influence of the various ductless glands upon metabolism, there is that of age and sex which must be taken into consideration in determining variations from the normal. In infancy the metabolism is extremely low, rapidly increasing up to five or six years, after which time there is a steady decrease in metabolism in relation to the weight and size. There is also a variation according to sex, males showing a greater metabolism than females.

In view of the many factors which may vary the basal metabolism in different individuals who are apparently in good health, the normal standards must not be too rigidly held. These are computed from a large number of presumably normal

people, and are the average findings. In different types of individuals, variations above or below the average normal may frequently be found. These variations may amount to ± 10 per cent. In women especially deviations occur; particularly during pregnancy when the B.M.R. is increased, and in a small number during menstruation.

As disturbance of the thyroid function is at the present time considered the most important cause of disturbance of the basal metabolic rate, we will record a number of observations to demonstrate its practical value.

Hyperthyroidism.—The present conception of this condition divides it into two main classes—namely, exophthalmic goitre and toxic adenoma.

(A) **Exophthalmic Goitre.**—The main characteristics of this type of hyperthyroidism is its comparatively sudden onset, and the frequency of its remissions and exacerbations. In addition, this class contains the vast majority of those cases which spontaneously return to normal, or which may rapidly reach a fatal issue. Inasmuch as certain of the classical signs of this disease may become permanently established, and vary but little during the changes in its course, it is customary to rely upon the variation of pulse-rate to indicate what this may be. In practice it has been found that the changes in the basal metabolic rate are much more reliable.

In Table III. there are recorded the findings of thirteen such cases. It will be noted that there was a conspicuous increase in the B.M.R. in every case. The one (13) with the greatest increase was of a particularly fulminating character, and in view of the associated phenomena, attributable most probably to an upset balance of the other glands, indicated a most profound disturbance. In comparing the B.M.R. and the pulse-rate, it must be borne in mind that these estimations were made synchronously. There is a rough parallelism between them, but it is clearly seen that there is not the close agreement that might be desired. This disagreement is not only evident in comparing different cases, but is also found at different times in the same case. This is particularly evident in cases 2, 5, 6, 8, and 11. Much of this apparent disagreement may be accounted for by the environment of rest in bed, which may bring about a decline in the pulse-rate without a corresponding improvement in the basic condition.

TABLE III.

Hyperthyroidism—(Exophthalmic Goitre).

No.	Age.	Sex.	Date.	B.M.R.	Duration.	Pulse.	Remarks.
				Per cent.			
1	18	F.	20.10.21	+20	1 year	73	Partial thyroidectomy four weeks ago.
2	21	F.	25.2.21	± 0	8 years	104	No glycosuria.
			2.3.21	+ 6		99	
			29.3 21	+12		106	
			27.4.21	+59		115	
3	45	F.	7.6.21	+45	1½ years	110	Glycosuria +.
			15.6.21	+35		104	
4	30	F.	12.4.21	+39	3 months	118	No glycosuria.
5	21	F.	19.2.21	+25	1 year	127	„ „
			16.3.21	+38		136	
			31.3.21	+ 9		90	
			11.4.21	− 5		99	
			28.4.21	+10		104	
			4.5.21	+25		126	
6	44	F.	30.5.21	+54	5 years	88	Glycosuria +.
			14.6.21	+75		101	
			29.6.21	+16		96	
7	23	F.	6.7.21	+23	1 year	126	No glycosuria.
8	58	F.	13.7.21	+39	9 years	124	Glycosuria, trace.
			28.7.21	+39		110	
			23.8.21	+14		88	
9	40	F.	2.5.21	+38	?	126	...
10	38	F.	29.4.21	+75	?	116	...
11	29	F.	10.9.21	+56	6 years	117	No glycosuria.
			23 9.21	+22		110	
			27.10.21	+24		92	
			9.11.21	+22		85	
12	29	F.	11.6.21	+22	...	96	...
			13.6.21	+22		88	
13	34	F.	15.5 21	+84	4 years	160	Died. Auricular fibrillation, acidosis, jaundice, glycosuria.

Those cases in which a series of observations were possible are interesting, as illustrating the variations in the course of this disease. This is particularly shown in cases 2, 5, 6, and 8. Case 2 was under observation until 30th March 1921, when apparently the disease was in a period of remission. In spite of this the exophthalmos was extreme. Four weeks later she returned for a few days for observation, and it was found that her condition was much worse, which was corroborated by the B.M.R., but not equally so by the pulse-rate. In case 5 we had the opportunity of observing the condition during a complete cycle of the disease. Somewhat similar but incomplete observations were obtained in cases 6 and 8. It is not our intention to deal with the causes of these periods of remission and exacerbation of exophthalmic goitre, but we have indications which would

lead us to hope that by further investigations we may be able to throw some light on its etiology. It has been the experience of a number of observers that this variation in the thyroid influence on metabolism is confined to a certain class of hyperthyroidism (exophthalmic goitre), and that operation is not indicated as the results are far from satisfactory, which would suggest that other functions than those of the thyroid are at fault.

(B) **Toxic Adenoma.**—This division of hyperthyroidism owes its identification to the work of Plummer and his associates. They recognised a type of hyperthyroidism which was not characterised by remissions, but which pursued a steady course through a long period of years. It was not associated with pronounced exophthalmos, although this may be present to a variable degree. The outstanding features are the steadily increasing or elevated B.M.R. over a considerable period, and the eventual development of serious cardiac phenomena such as auricular fibrillation and flutter. In Table IV. is recorded

TABLE IV.

Hyperthyroidism—(Toxic Adenoma).

No.	Age.	Sex.	Date.	B.M.R.	Duration.	Pulse.	Remarks.
				Per cent.			
14	44	F.	5.2.21	+48	14 years	130	Auricular fibrillation. Jaundice. No glycosuria. Died.
15	42	M.	27.6.21	+36	27 ,,	90	
			28.6.21	+42		96	
			21.7.21	+60		104	After ligation.
16	51	F.	16.5.21	+58	30 ,,	146	Auricular fibrillation.
			21.6.21	+45		96	Glycosuria.
			30.6 21	+36		103	
17	39	F.	1.9.21	+44	8 ,,	132	...
			16.9.21	+34		107	...
18	39	F.	29.3.21	+41	18 ,,	112	Auricular fibrillation.

five cases of this condition. The uniformly high rate of the B.M.R. which averages an increase of 42·4 per cent. will be noted. The high incidence (60 per cent.) of auricular fibrillation is quite characteristic of the condition. The more usual symptoms of hyperthyroidism were conspicuous by their moderation. Exophthalmos, goitre, and general nervous phenomena were not at all prominent. This is quite characteristic of the lesion and may partly account for the chronicity of the disease. It is not infrequent that medical advice may be sought on account of the cardiac condition which eventually

dominates the clinical picture. It is in such cases that the B.M.R. gives the most valuable information, as by it such cases may be detected in their earlier phases. This is very important, as these cases on account of their special pathological nature are most effectually treated by operation. This, however, must be performed before cardio-vascular symptoms become advanced.

It has been found that cases of cardiac failure may show an increase in the B.M.R. which disappears when the cardiac condition improves. This is demonstrated in case 16 where there were signs of cardiac failure with auricular fibrillation on admission. This improved on rest and tincture digitalis with a coincident lowering of the B.M.R.

Simple Goitre.—In Table V. are found records of nine cases of so-called simple goitre. It will be noted that there is little or no increase of the B.M.R., but a tendency to a decrease. There is one case, No. 22, which is an exception. It will be noted that the variation of the B.M.R. is of the same order as the case of exophthalmic goitre No. 5, Table III. The only other symptom to indicate this possibility was a pulse-rate of 120 on admission, which returned slowly to normal on rest in bed.

TABLE V.

Simple Goitre.

No.	Age.	Sex.	Date.	B.M.R.	Duration.	Pulse.	Remarks.
				Per cent.			
19	12	F.	18.2.21	± 0	6 months	92	...
			13.3.21	+ 4		96	...
			13.4.21	+ 11		72	...
20	19	F.	2.3.21	− 25	3 „	76	...
			14.3.21	− 5		72	...
21	16	F.	25.5.21	− 10	2 years	71	...
			31.5.21	− 17		70	...
22	17	F.	29.4.21	+ 29	1 year	96	...
			27.5.21	+ 9		82	...
			1.6.21	− 4		75	...
			8.7.21	+ 22		86	...
23	18	F.	22.7.21	− 10	6½ years	80	...
			3.8.21	+ 10		84	...
24	17	F.	22.3.21	+ 3	4 „	80	...
			4.4.21	− 1		68	...
			20.6.21	+ 5		72	...
25	17	F.	12.10.21	− 4	5 „	79	...
			29.10 21	− 14		73	...
26	15	F.	12.10.21	− 14	1½ „	55	...
			28.10.21	− 19		56	...
27	17	M.	6.7.21	− 2	?	73	...

The relationship of simple goitre to future hyper- or hypothyroidism is one of great interest but requires much additional careful investigation.

Hypothyroidism.—In cases of hypothyroidism or myxœdema the B.M.R. is persistently and steadily decreased, while with the beneficial administration of thyroid extract it returns. The case noted in Table VI. followed operation for removal

TABLE VI.

No.	Age.	Sex.	Date.	B.M.R.	Duration.	Pulse.	Remarks.
				Per cent.			
28	30	F.	21.3.21	− 20	3 months	62	Post-operative myxœdema.
			1.4.21	− 13		73	
			10.11.21	− 28		64	

of the thyroid. Besides the decrease in the B.M.R. there were other signs suggestive of thyroid deficiency. Thyroid extract in increasing amounts eventually cleared up all these symptoms and the B.M.R. tended to return to normal. But as the administration of thyroid extract continued she developed palpitation and headache. Although otherwise feeling much better, she was forced to withhold the drug. In a few weeks she noticed that the skin of the face and hands was rapidly becoming "thick." She restarted the thyroid extract, with an immediate disappearance of the symptoms, but an eventual return of the tachycardia. On 25/10/21 she was again forced to stop the taking of the drug, with a rapid return of the myxœdematous symptoms which were quite evident when seen on 10/11/21. It will be noted the B.M.R. was lower than on any previous occasion.

At the present time many cases suffering from a variety of indefinite nervous and other symptoms are suspected of having disturbances of the thyroid function. In such cases the B.M.R. may render very variable aid in coming to a definite diagnosis. It must be emphasised, however, that one observation may not be conclusive, and it may be advisable to determine the patient's B.M.R. frequently over some months before coming to a definite conclusion.

In conclusion, the above observations indicate the very definite value of estimations of basal metabolic rate, but it must be realised that it represents but one phase of the functions of an extremely complex system of glandular activity and balance.

Therefore it must be assessed at its true value and not be expected to solve all the riddles in the diagnosis of disturbances of internal secretions.

REFERENCES.—[1] Boothby and Sandiford, *Basal Metabolic Rate Determinations*, Saunders, Philadelphia and London, 1920. [2] Dautrebande and Davies, *B.M.J.*, in the Press. [3] Dautrebande and Haldane, *Journ. of Physiol.* [4] Haldane, *Methods of Air Analysis*, Griffin, London, 1918. [5] Zuntz and Schumburg, *Studien zu einer Physiologie des Marsches*, Berlin, 1901. [6] Aub and Du Bois, *Arch. Int. Med.*, 1917, xix., 823. [7] Du Bois and Du Bois, *Arch. Int. Med.*, 1916, xvii., 863. [8] Harris and Benedict, Carnegie Institute, Washington Publication, 1919, p. 279.

Boothby quotes numerous references in a recent article on "Thyrotoxic Adenoma," *Endocrinology*, vol. v., p. 1, 1921.

THE WASSERMANN TEST IN GENERAL PRACTICE.

By ARTHUR MILLS, M.D., Dundee.

FOR a period of about two years I have taken advantage of the Wassermann test as an aid to the diagnosis of syphilis in general practice. The experience is too limited to enable one to form definite conclusions, or to demonstrate new facts, and I do not presume therefore to offer anything more than a few clinical impressions and speculations. The impressions which I have formed are derived from cases which I have observed in my own practice. They are also to a certain extent the outcome of discussions with Mr D. M. Greig, whose experience of this subject is very great, and to whom I shall always be indebted for much valuable enlightenment.

It must be stated at once that I am of opinion that when Professor W. J. Tulloch of the Bacteriological Department, University College, Dundee, reports a blood "definitely positive," without reservation, the owner of that blood is the subject of syphilis. Every such report I have had has been proved to be correct, and has been confirmed by the clinical history of the case or by the results of treatment or by both. I have no knowledge of the value of reports from other laboratories. It is difficult, however, to form an estimate of the real worth of the Wassermann test as proof of cure or absence of cure. I have found that the clearing up of all symptoms of the disease, and the changing the serum reaction to negative are two very different propositions. The following are my clinical impressions and speculations. Some may be old and some may be self-evident. I trust that one or two may be fresh, and of interest.

A patient suffering from inherited syphilis may have a positive father and a positive mother, or a positive father and a negative mother. I have not yet met with one having a negative father and a positive mother. A positive father may propagate syphilitic children long after he has ceased to be directly infective to the mother.

Inherited syphilis is much more common than we were aware of. In an Industrial School of which I am medical officer, 70 per cent. of the children are the subjects of inherited syphilis. This is, of course, a very high percentage, and, I am

aware, can afford us little information with regard to the frequency of the disease amongst the general population, for the parents of these children are of the lowest type in the community.

Many patients display none of the orthodox cardinal signs, such as typical physiognomy, Hutchinson's teeth, interstitial keratitis and scars round the mouth. An infant may be suffering from inherited syphilis, though there be no history of rash, snuffles, or condylomata. Inherited syphilis may manifest itself in a variety of other conditions, curable by anti-syphilitic treatment, and these conditions were not recognised in the past as being caused by syphilis.

Dietetic Difficulties in Infancy.—The sole manifestation of inherited syphilis in an infant may be dietetic difficulties, with little or no increase in weight or with actual wasting. The blood is found to be positive, and anti-syphilitic treatment is followed by steady growth. It is of interest in this respect to read, for example, what Hutchison says in his *Lectures on Diseases of Children*, published in 1906. He is discussing different diets for infants, and having described three diets of what he calls the "positive, comparative, and superlative of digestibility," he proceeds: "But if you fail even *with* peptonised milk, what then? Well, gentlemen, the resources of civilisation are not yet exhausted . . . try the effect of a little grey powder. Grey powder seems to fatten some children just as cod-liver oil does." He is careful to explain, too, that such children may be free from any syphilitic taint, and he confesses he is unaware how the grey powder acts. He was not aware, as we are now, that the dietetic difficulty itself may demonstrate a syphilitic taint and be the sole manifestation of the disease. I suggest that the successful though purely empirical use of grey powder in the past was in these cases due to its specific action in syphilis.

Abdominal Pains.—Inherited syphilis may explain recurring attacks of gastro-intestinal disturbance in older children and in adults. In particular it may explain attacks of abdominal pain which may lead to a diagnosis of appendicitis, gall-stones, Dietl's crisis, and probably of other acute abdominal conditions. I consider this group of cases an exceedingly important one and worthy of illustration. I have notes of one case where floating kidney was the diagnosis, another where duodenal ulcer, gall-stones, and diaphragmatic pleurisy were each the

ultimate diagnosis. I have notes of two such cases in which the symptoms led to removal of the appendix. One operation was done late at night as an emergency, the symptoms being considered urgent. In both cases the pathological report on the appendix was negative, and in neither case did the operation reveal any surgical condition within the abdomen. It is of interest, too, that the patients are brother and sister. The sister is now 27. She was taken to see a consultant in Edinburgh at the age of 11 for recurring gastro-intestinal attacks, nervousness, and slow development. A sharper abdominal attack than usual led to an urgent appendicectomy being done in 1917. The appendix, as I have said, was normal, and her abdominal pains continued to annoy her. The correct diagnosis was made a few months ago, and anti-syphilitic treatment is having quite a definite and satisfactory effect. I suggest that these attacks of abdominal pain are of the nature of visceral crises and due to some disturbance of the nerves supplying the abdominal organs. They have the same paroxysmal character as the crises of tabes. I fail to see why such crises should not occur in the absence of locomotor ataxia, and suggest that it is syphilis and not the condition of tabes which causes the crisis. It is of interest, too, to note that in the treatment of tabes with salvarsan, although results are disappointing as regards the tabetic condition, improvement is frequently reported as regards the visceral crises. Visceral crises and root pains are usually grouped together as being of similar origin. I think this may be incorrect, and I note that Purves Stewart regards visceral crises as probably due to irritation of the abdominal sympathetic.

I suggest that in dealing with the acute abdomen the possibility of what might be termed a syphilitic visceral crisis should be kept in mind, and this though there be no evidence whatever of the patient suffering from tabes.

Tuberculous Peritonitis.—Experience has taught me that syphilis can produce in a young child a condition impossible to distinguish from tuberculous peritonitis, and that this condition may clear up in a satisfactory manner under anti-syphilitic treatment. Here again one calls to mind the successful though empirical use of mercurial ointment in the treatment of supposed tuberculous peritonitis in the past.

Anæmia.—The external appearances of anæmia of a persistent nature and not improved by medication with iron

may be the sole manifestation of inherited syphilis. The patient probably comes complaining of lassitude and weakness, and may volunteer the information that she has always been told "she was very anæmic." Such a case responds to anti-syphilitic treatment in a very gratifying manner, the change in colour being noticeable in a few months time. I am very doubtful, however, about the condition being one of true anæmia. It is indeed difficult to estimate the degree of any anæmia from external appearances, and a few estimates by the Tallquist method certainly did not confirm the existence of a true anæmia. Is the pallor not again due to a disturbance of the nervous system, and more especially the vaso-motor system? Do these patients, in other words, go about with white faces and full splanchnic vessels—a state of more or less chronic nausea—accounting also for their weakness and their weariness. Whatever their appearance be due to, the change following anti-syphilitic treatment is most gratifying.

Affections of Bones, Joints, and Glands.—This group comprises a most interesting and important class where the Wassermann test disclosed the true nature of the condition. A boy of 12—twice operated upon for cervical glands, one finger amputated, and a leg in a splint for nearly two years—positive Wassermann—treatment—to school in six months. He went to school in September 1920 and has not been absent since. Observation of this and of several other similar cases leads me to believe that numerous operations have been needlessly performed, glands removed, digits and limbs amputated, and joints excised, and that we must be very wary indeed in making a diagnosis of surgical tubercle. I now understand why a Scott's dressing has so often cured a so-called tuberculous lesion in the past. How often have such tuberculous conditions been confirmed by pathological report? Is it possible to determine with certainty the tuberculous nature of a lesion by pathological examination?

Epilepsy, we are well aware, is frequently the result of syphilis. A patient suffering from inherited syphilis may exhibit epileptiform seizures, which may be kept under complete control with bromide. We are aware, too, that bromide taken over a long period may eventually cure certain cases of epilepsy, the fits not recurring after cessation of the bromide. It would be interesting to know when an epileptic is actually cured by bromide whether the case was not invariably a syphilitic one,

and whether the bromides are not similar in their action in syphilis to their near neighbours the iodides.

Miscarriages may be predisposed to by inherited syphilis. I believe I am correct in stating that inherited syphilis in the pregnant woman has not been considered a cause of abortion. When a woman miscarries one naturally thinks of syphilis and one may obtain a positive Wassermann. I have found, however, that it is inadvisable to make the hasty diagnosis of syphilis acquired, and presumably acquired from the husband. The husband's blood may be negative, and further investigation may prove the mother's condition to be an inherited one. I do not suggest that the virus is transmitted in these cases to the fœtus. We have up to the present no proof that this can occur. We are accustomed, however, to think of "anæmia" as a predisposing cause to abortion, and I suggest that this so-called anæmia may in certain cases be the result of inherited syphilis.

Anginal Symptoms, not necessarily those of true angina pectoris, are naturally a frequent result of syphilis. I treated two such cases at the same time, a male and a female of about similar ages. Pain was the outstanding symptom in both cases, and there could be no doubt that syphilitic arterial degeneration and resultant attacks of arteriospasm were the cause. I was much struck by the effect of the administration of potassium iodide in both cases. It aggravated very much their pain and discomfort, and it was quite impossible to go on with it. I think we have much to learn regarding the physiological action of this drug. I was also impressed, as I have frequently been, by the satisfactory response to treatment on the part of the female as compared with the male. A woman appears to respond much better than a man to anti-syphilitic treatment.

Respiratory Tract.—I have under observation a patient who has suffered for three or four years from cough, profuse expectoration invariably negative for tubercle bacillus, breathlessness on exertion, spells of slight pyrexia, and has thrice had an attack of hæmoptosis. His condition has been diagnosed by one doctor as phthisis, by another as chronic pneumonia, by another as a mediastinal lymphatic growth, and by another as bronchiectasis. His blood is definitely positive, and in my opinion his respiratory trouble is syphilitic in origin and probably a gummatous infiltration of the bronchi possibly producing bronchiectasis.

Nervous System.—I have under observation a patient who

was in the Dundee Royal Infirmary in November last. In spite of the fact that her serum gave a definitely positive reaction her case was diagnosed as disseminated sclerosis, and it was not considered that she would benefit by anti-syphilitic treatment. Her symptoms as noted on her case sheet were briefly as follows :—Diplopia, vertigo, headache, paralysis of one superior oblique, right pupil larger than left, reflexes all increased, double ankle clonus present one day and not the next, disturbance of sensation left arm, leg, and left trunk, Romberg present, patient falling to left side, unsteady gait, right leg stronger than left, thick articulation, mental instability. She was discharged from the Infirmary in early December last, very ill and quite unable to walk, her left leg being quite helpless. I arranged that she should receive a thorough course of anti-syphilitic treatment, and I examined her on 24th April last, four months after treatment was started. My notes on that date are as follows :—She says that she is in better health than she has been in for five years, has done all her own housework for some weeks, and is at present spending a few days with friends in the country. She walks perfectly, without the least sign of lameness. Her signs and symptoms as noted in her case sheet have entirely disappeared and her reflexes are normal. On close cross-examination she admits occasional difficulty in articulation when speaking quickly, and a twitching of the legs when tired after much walking. She appears to be making a satisfactory recovery.

I suggest that syphilis can give rise to as many symptoms as there are functions of the nervous system. Disturbances produced by syphilis may bear the character of either functional or organic. Though organic in character, they need not be permanent and incurable. The exudative stage of irritation may not have developed into that of destruction or degeneration. No neurological case is completely investigated without examination and report on serum and cerebro-spinal fluid. In this particular case the fact that the serum was positive was in my opinion sufficient to shift the burden of proof. In other words it was necessary then to prove that her condition was not due to syphilis. As a matter of fact the results of treatment prove conclusively that her condition was due to syphilis and that disseminated sclerosis was an incorrect diagnosis.

Acquired Syphilis in Children.—I find that one must not only be constantly on the outlook for unusual and remote

symptoms of inherited syphilis, but that the possibility of a child having acquired syphilis must not be forgotten. The following are a few notes on what I consider to be three cases of syphilis acquired in early childhood.

This is the story of John, aged 12½, and Mary, 6½, brother and sister.

On 5th October 1920 John was brought to me—complaint, headaches of very severe character, occasional vomiting during past three or four months, and more recently epistaxis. He was thin and looked pale and listless. He had been kept at home from school for a day or two at a time at frequent intervals. I had a lively recollection of treating his sister Mary, and looking up my notes found that during April, May, and June of 1920 I had treated her for what I looked upon then as tuberculous peritonitis. She had had the advantage of open-air treatment, lying out in a hammock in the garden most days, and receiving every attention as regards diet and nursing. She made no progress till she was put on mercury, and she then made a rapid and complete recovery. I made a resolve at the time to "have that blood some day." Being now, on 5th October 1920, consulted about her brother John, and thinking his symptoms suggestive, I took his blood forthwith. It was definitely positive. My natural conclusion was—here is a family suffering from inherited syphilis, and I proceeded to have all their bloods. A few days later I got the following results:—*Parents*—Father, 36, healthy—definitely negative; Mother, 38, healthy—definitely negative. *Children*—Daughter, 15, not taken; John, 12½, positive; son, 9½, negative; son, 7½, negative; Mary, not taken; daughter, 4½, not taken.

This was decidedly confusing, but I remembered that when called in to see John in early 1915, who was then suffering from a febrile illness I could make nothing of, his maternal grandmother showed me a rash on her arms very suggestive of syphilis, and which cleared up on specific mixture. Further, in 1917 and 1918 she had been treated for iritis which was regarded as syphilitic, and for an ulcer on the leg which a surgeon also diagnosed as due to syphilis. Further, in July 1919 I was called to see the maternal grandfather, who had been off work for a long time, and had been "treated for his kidneys and weakness." He was thin and weak, nervous and excited, and complained of a distressing discharge which he

had difficulty in clearing from the back of his nose. He would rouse the household in the middle of the night stamping and swearing and trying to get rid of this discharge. I remembered his wife and took his blood—it was definitely positive. He got better on appropriate treatment and returned to his work in January 1920.

Mary's blood was obtained on 3rd February, and was definitely positive. I have still to get specimens from the eldest and youngest, but I am confident they are negative. They are perfectly healthy children like the other two negatives, and in general appearance a great contrast to the two positives. When John and Mary were infants, their grandparents were evidently suffering from acute and infectious syphilis, and all were living together in the same house. The inference is obvious. I can get no history of primary or secondary symptoms in either case. When John was 4½ it appears he was operated on for "tuberculous" glands in the neck, an example probably of a needless operation. He shows the scar, but the glands have not recurred. Both John and Mary are doing very well indeed.

This is the story of Peter, aged 12. In December last I was called urgently to see Peter, because he had "taken a fit." I had never seen Peter or any member of his family before. The story was that for a week or two he had been out of sorts and appeared to be more easily tired than usual, and weaker on his legs, and had therefore been kept at home from school for the past fourteen days. To-day he was playing with his sister decorating the house for Christmas, when she suddenly observed that he was leaning in a helpless fashion against the steps with a dazed look in his eyes, very pale and evidently unable to speak. He was carried upstairs and put to bed. I found him cold and pale, lips blue, no evident paralysis, quite unable to articulate—not unconscious and understanding everything that was said—pulse 96, temperature 99·5, respirations 20, tongue furred, had vomited once or twice after getting some hot water to drink, frontal headache, knee jerks, plus no ankle clonus, tongue was protruded slightly to left side, no atrophy of tongue. He showed nystagmus associated with congenital cataract. Two days later he spoke in his normal manner, which is rather slow and slurring in character. His temperature was normal, tongue cleaner, and he felt well. The mother reported Peter was born at full term and was breast fed, and that his

eyes were operated on several times for congenital cataract. He walked at fifteen months but was never strong on his legs. After walking some distance his legs become feeble and show twitching movements. Has been growing quickly during the last two years. Had usual childish ailments, is sensible, intelligent, has good memory, poor at figures, in third standard at school. Vision is very defective. His blood was examined on 6th January, and reported definitely positive. The bloods of the father, mother, and other children were then immediately obtained, and all were reported negative. All the children are alive. The mother had no other pregnancies and no miscarriages, and there was no history of syphilis in either parent. On 3rd February, Peter's blood was again taken and reported definitely positive. The mother states that when Peter was an infant she had great trouble with a maid who used to take Peter out every day. It was found that she habitually took the infant into her own relatives' and friends' houses, and she was finally dismissed for staying out at night and presumed immorality. The sort of seizure described here is again, I think, suggestive of syphilis, and in spite of the absence of history of primary and secondary symptoms, I believe the case to be one of acquired syphilis. The response to treatment in these three cases of acquired syphilis in children has so far been exceedingly gratifying. I have no experience of others.

CRITICAL REVIEW

CÆSAREAN SECTION: ITS INDICATIONS AND TECHNIQUE.

By J. W. BALLANTYNE, M.D., F.R.C.P.E., Lecturer on Midwifery and Gynecology (to Women Students) in the University of Edinburgh.

Since Dr Amand Routh in 1911[91] published his valuable monograph bringing the history of the Cæsarean section in the United Kingdom up to the year 1910, a great deal of work has been expended on the subject, and many articles have appeared dealing with one or other of the numerous aspects of the operation, including at least one other large conjoint investigation, that by Dr Eardley Holland[46, 47] on rupture of the Cæsarean section scar in subsequent labours and pregnancies. The present critical review will deal only with the contributions which have been made to the subject during the three years 1918, 1919, and 1920, with a few references to 1917 and 1921 cases; it does not pretend to exhaustiveness, but it will be found to touch upon all the vital matters in the recent history of the Cæsarean section.

There can be no doubt that during these three or four years there has been a steady growth in the favour with which obstetricians have come to regard the Cæsarean operation. The indications which were formerly regarded as pointing to the performance of the section, have been more clearly defined; new indications have been recognised as justifying its employment; the technique has been improved; and both the maternal and the infantile mortality resulting from its use have been further lessened. All that was called for has not yet, however, been accomplished: the exact limits of suitableness of the operation in cases of placenta prævia and eclampsia have not been fixed; the ideal technique in certainly, and in presumably, infected cases has not been discovered; and the maternal mortality and morbidity have not been reduced so low as to warrant the obstetrician in pressing the operation upon the parents when there are alternative procedures with less risk to the mother. But progress has to be recorded in all these directions.

It is an interesting fact that a change in public sentiment regarding the value and the sacredness of antenatal life has had something to do with the extension of the Cæsarean section to cases and conditions in which it would hardly have been seriously considered some ten or twelve years ago. The mother's life is, of course, still regarded as of the greater value, and where *one life must be sacrificed it will still be the child's;* but the appreciation in the worth assigned to antenatal

and intranatal life is making itself felt in obstetrics, and this at least may be said that no obstetrician now lightly performs craniotomy upon the living infant, whilst to many the occasional occurrence of such a necessity is deeply regretted and accounted as a failure in preventive midwifery. The immediate practical bearing of this new view-point is evident at once when the use of Cæsarean section in placenta prævia is considered.

Cæsarean Section in Placenta Prævia.

When Lawson Tait,[101] more than thirty years ago, proposed the Porro Cæsarean section in cases of placenta prævia he was actuated chiefly by the desire to lessen the maternal mortality, and he argued that the removal of a uterus doubtless diseased and most probably infected would bring this about. His proposal was scarcely regarded seriously at the time; it was not till 1894 that Bernays reported "the first successful case of Cæsarean section in placenta prævia"; and it was only in the early years of the present century that the operation began to be much talked about and sometimes practised. In 1900 Dudley[30] claimed the Cæsarean section as "an ideal method of treatment for placenta prævia," whilst two years later Ehrenfest[33] was found writing on its "impropriety." By this time the argument of the greater safety to the child was beginning to have some force. Since then, and more especially during the past few years, a large literature has grown up round this extension of the indications for the section, and the question now calling for settlement is the definition of the sphere of usefulness of the operation in antepartum hæmorrhage due to placenta prævia.

Some obstetricians are whole-heartedly in favour of Cæsarean section for placenta prævia. Emerson[34] goes so far as to say that all other methods should be discarded in its favour, and Lapthorn Smith[99] is also an enthusiast. Arnold Jones,[55] too, thinks well of it. It is interesting, however, to note that Emerson, with 120 Cæsarean sections and only three maternal deaths, performed the operation for placenta prævia only six times, and that two of the deaths occurred in these six cases. Applegate[2] in 95 operated cases of the section found placenta prævia an indication five times, and he had no maternal deaths to deplore; but he would discriminate to some extent, and he names three conditions which in his opinion constitute positive indications for Cæsarean section in placenta prævia. The three conditions are: (1) placenta prævia with a contracted pelvis causing actual disproportion and a living child; (2) placenta prævia with a rigid unyielding os and a living child; and (3) central placenta prævia with a living child past the age of non-viability, without respect to the size of the pelvis. It is to be noted that save in central placenta

prævia Applegate's choice of Cæsarean section is determined by the concomitant conditions (size of pelvis and state of os). Bill[9] also writes favourably of the section in placenta prævia, but he lays great stress upon the prophylactic transfusion of blood in such cases for otherwise they have a bad operative risk. Beck[7] is rather inclined to lay stress upon the risk of pre-infection on account of the packing of the vagina which has been carried out before the patient's admission to hospital. In 37 operations he performed the section once for placenta prævia: the os was only 2 cm. dilated, the placenta completely covered it, and the child was in good condition; but the infant was premature and died twelve hours later. In the interest of the child the pregnancy should be near or at the full term, and, as already stated, there should not have been plugging of the vagina. Brodhead[12] is inclined to limit the indications for the section to all patients at or near term with central placenta prævia, and to primiparæ at or near term with partial placenta prævia and no cervical dilatation. Asa B. Davis[26] performed abdominal Cæsarean section 348 times, on twelve occasions for placenta prævia; and he conscientiously believed that several mothers who had been lost from placenta prævia treated in other ways would have been alive if the section had been performed. R. L. Payne[80] believes in the restriction of the section in placenta prævia to a very few cases, namely, to those associated with obstruction, in which the placenta is central, and in primiparæ with a small vagina and a rigid os; he also thinks that the operation must be done by an expert working under ideal conditions. He is not impressed with the hope of saving the child because so many of them are immature. E. P. Davis[27] lays stress upon the condition of the membranes in choosing abdominal Cæsarean section in placenta prævia; where these are not readily available he would perform the section, but where they can be reached he would pull down a leg. He delivered by the section in 27 cases of placenta prævia and lost two of the mothers; "all the children in fairly good condition survived the operation." Hellier[45] is of opinion that Cæsarean section in placenta prævia is, under certain circumstances, an excellent plan of treatment. He records two cases in which he successfully employed it; in one the placenta prævia was complicated by pelvic contraction, and in the other by impending eclampsia. Schumann[94] states that central placenta prævia with a viable child and no dilatation of the cervix, especially in primiparæ and women not in labour, is a most definite indication for abdominal Cæsarean section in the best interests of both mother and child. Essen-Möller's view[35] is guarded; he would restrict abdominal Cæsarean section to the cases in which the hæmorrhage is serious (the cervix not being sufficiently dilated to permit version), and in which the mother is certainly not infected. He has operated seven times and

has lost one mother from embolism. Schickelé[92] is careful to point out a fact which is sometimes lost sight of, viz., that when death follows the use of Cæsarean section in placenta prævia it is not to be ascribed to the operation *per se* but to the co-existing anæmia. With this fact clearly in mind he would limit the cases to those in which the section can be done before the anæmia has become acute and before there are signs of infection. He also emphasises the rule that it is not the cervical Cæsarean and still less the vaginal operation which is to be used in placenta prævia; the uterine incision must be made above the lower uterine segment. Other writers also lay stress on this matter. Lequeux[62] gives indications for the section as follows: (1) Arrival of the ninth month of pregnancy; (2) grave degree of hæmorrhage; (3) a long rigid cervix; (4) non-distension of the lower uterine segment; and (5) absence of signs of infection and even of subinfection. Boquel[10] is convinced of the rarity of the necessity for surgical intervention in placenta prævia; when it is really required then it ought to take the form of abdominal Cæsarean section. He reports a case in which he delivered by this means and the patient subsequently had two normal labours; consequently he is not inclined to take the gloomy views held by some of the danger of future pregnancies. Ipsen[52] lays the emphasis upon the absence of infection in cases of placenta prævia deemed suitable for Cæsarean section; he would operate early before the cervical canal has reached a diameter of 4 to 5 cms. Professor Bar[5] thinks the number of cases suitable for Cæsarean section is small; he would limit the operation to instances of grave hæmorrhage (pointing to central placenta prævia) in which the os is not open, the membranes not accessible, and infection not present. In a discussion on the treatment of antepartum hæmorrhage in 1920,[96] Drs Fletcher Shaw, Herbert Spencer, Blair Bell, and others spoke of Cæsarean section as being suitable in certain cases of placenta prævia, the necessary conditions being considerable hæmorrhage, a living child, and lack of dilatation of the cervix. Kosmak[58] holds very similar views, stating that in primiparæ with a rigid and only slightly dilated cervix, with the probability of a central placenta prævia, with the child at or near term and still in good condition, and with bleeding which has not been extreme, the Cæsarean section offers the best method of delivery both for mother and child. Kosmak adds, however, the significant sentence that the large majority of cases will be found to be outside this group.

There are, however, obstetricians who prefer the older methods of treating placenta prævia by Braxton Hicks' version or the use of the hydrostatic bag (intra-ovular or extra-ovular) to Cæsarean section. Whitridge Williams,[111] for instance, writing in 1917, regarded the frequent employment of the section in placenta prævia as one of its

abuses. He admitted two arguments in its favour: the first was the saving of more infantile lives, but against this he put the fact that many of these children were premature; and the second was the saving of time in delivery, a consideration which he thought ought not to weigh very much. Writing in the present year (1921) Williams[112] has given a critical analysis of his twenty-one years' experience of Cæsarean section, including 183 operations; he performed the section once only for placenta prævia (although there were 66 placenta prævias in that period), and in that case he lost the mother, an elderly primipara suffering from chronic nephritis.

From what has been stated in summary it will be recognised that whilst obstetric opinion has not yet been consolidated regarding the precise place of Cæsarean section in the treatment of placenta prævia, there are indications of the probable restrictions which will certainly be imposed on it. For instance, it will be rather for the child's than for the mother's sake that it will be done. For this reason, therefore, it will usually be passed by in cases in which the fœtus is believed to be dead or dying, and in those in which it has not reached full viability. The reviewer is of opinion that it is hardly wise to do the section unless the eighth month of antenatal life is passed. Further, it will be reserved for the presumably central type of placenta prævia. The word "presumably" is used, for it is not always possible to diagnose the central position of the placental insertion at the time when the Cæsarean section has to be decided upon. Some writers emphasise the amount of blood lost, but this is not a safe guide to the conclusion that the placenta is central. Further, there is a difference of opinion with regard to the significance of hæmorrhage, some looking upon great blood loss as an indication for the section and others placing it among the contra-indications; certainly it will be wise to take measures for the restoration of the circulating fluid by transfusion and the like before the section be performed where there has been great blood loss. Nearly all are agreed that the cervix should still be undilated in the ideal case for the section, and that therefore the elderly primipara with a rigid cervix is particularly suitable for such intervention. If possible, also, there should be signs neither of infection nor of sub-infection, a restriction which tends to exclude the cases sent into hospital with vaginal packing of small amount and of dubious asepticity. It goes without saying that the presence of an additional cause of difficulty in labour will often turn the scale in favour of the section in an otherwise doubtful case; for instance, the co-existence of pelvic contraction or of impending eclampsia or of fœtal malpresentation will help the making of a decision. From what has been said it follows that Cæsarean section is likely to be chosen in only a few cases

of placenta prævia, more especially as, when chosen, it ought to be done in a hospital and by an expert; but, on the other hand, the development of the antenatal clinic, leading to earlier detection of placenta prævia before hæmorrhage has become great and before infection has been rendered probable, will tend to bring within the range of the operation cases which would otherwise have lain outside it. Whatever be the sphere of its usefulness in the future, there can be no doubt that in many quarters at the present time there are signs of a revolt against the practice of so often sacrificing babies by making them act as plugs to save their mothers' lives.

In his series of Cæsarean sections in recent years the reviewer has operated once for placenta prævia with a successful result; in a second case the circumstances were favourable but a chance prevented him doing so, and, since the fœtus turned out to be an anencephalic, there was no room left for regret.

Cæsarean Section in Accidental Hæmorrhage.

The field for Cæsarean section in cases of accidental hæmorrhage is even more restricted than that in placenta prævia. By general consent or by the necessities of circumstances it is only in very serious cases that it is thought of. The state of the uterine wall is such that contraction does not follow the section, and therefore when operative treatment is given it usually takes the form of supra-vaginal hysterectomy. Dr E. P. Davies,[27] however, recommends Cæsarean section as "the most prompt and satisfactory treatment," and gives as reasons the facts that such cases usually occur where the cervix is little if at all dilated and where efforts to dilate it rapidly are dangerous, while gradual dilatation produces additional separation of the placenta and renewed bleeding. Essen-Möller[35] has reported 10 Cæsarean sections (out of a total of 106 abdominal sections) for the conjoined indication of eclampsia and accidental hæmorrhage; three of the mothers died. Whitehouse[109] pleads for early operation in accidental concealed hæmorrhage, the form to be supra-vaginal hysterectomy. Fletcher Shaw[96] advocates Cæsarean hysterectomy only for the severe cases of accidental hæmorrhage which do not respond to the ordinary methods of treatment; and he records some failures with a frankness which has in itself a higher value than what is found in many lists of "successes." There were seven cases of serious accidental hæmorrhage of which two were delivered *per vias naturales* and five by Cæsarean section; in one of these seven Shaw did a vaginal hysterectomy by clamps, in another he did an abdominal pan-hysterectomy, and in the remaining five he performed supra-vaginal hysterectomy with ligatures. All the babies were lost and four out of the seven mothers; but then they were all hopeless cases,

for in all of them the uterus made no effort at all to contract after the extraction of the child. Fletcher Shaw is probably justified in thinking that the hysterectomy saved the three mothers who survived.

At the present time there would seem to be a general opinion that abdominal operative interference is rarely called for in accidental hæmorrhage, and that when these rare indications (concealed hæmorrhage in an inert uterus) occur the interference ought to take the form of hysterectomy. The reviewer has done Cæsarean section in one case of accidental hæmorrhage, but the original indication for the section was a small pelvis, the accidental hæmorrhage coming on in the period of preparation of the patient probably because of fright; the mother survived but the baby was so asphyxiated at birth as to be irrecoverable.

Cæsarean Section in Eclampsia.

Eclampsia is still so grave a complication of labour that it is no wonder that so many obstetricians are loath to abandon Cæsarean section as a method of treatment, more especially as many believe in the fœtal or placental cause of the toxæmia. Certainly if that theory of origin of eclampsia be correct, the section ought to give the best results by rapidly removing the cause of the toxine. Some writers claim that such is the cause and that the section is successful. Lapthorn Smith[99] had a successful case, and writes of removing the cause in one minute or at most in five; and Genge[40] also reporting one case affirms that "Cæsarean section is a dramatic and successful way of dealing with eclampsia." Emerson,[34] too, is strongly in favour of it, and employed it in 8 cases (out of 120 Cæsarean sections) with the saving of the mother in each instance.

Among recent authors, however, there are many who are critical about the value of Cæsarean section in eclampsia, some because they doubt the theory of causation which it implies, others because they prefer prenatal supervision and medical methods of dealing with the toxæmia, and yet others because they deny that good effects follow its use. Whitridge Williams[112] in a series of 183 Cæsarean sections on 145 women performed the operation nine times for eclampsia, but he is no longer in favour of it. Parke[79] is of opinion that the right treatment in eclampsia is to end the pregnancy and to do it quickly, but he would not in every case use the Cæsarean abdominal section. In some instances he would do the accouchement forcé, in others he would employ the vaginal Cæsarean section, and in a third group he would look to abdominal Cæsarean section. He would choose it, for instance, when the eclampsia is complicated by disproportion between the head and the pelvis, or by tumours or deformities obstructing the passages. Indications he would find in primiparæ before labour

has set in or immediately after it has begun, and with a living and viable child not far from full term; in multiparæ not in labour, near term, and with rigid and high placed cervices he would also prefer the section. He would consider it as contra-indicated if frequent vaginal examinations spread over a long period had been made, if the membranes were broken, if unsuccessful attempts at delivery had been made, if there was a risk of infection, and if no capable operator working in favourable surroundings was available. In the discussion which followed the announcement of Parke's somewhat restricted field of operational suitability, G. M. Boyd and E. P. Davis stated that they favoured prophylaxis and non-operative methods, and Norris thought that abdominal Cæsarean section was not the only treatment even in primparæ. Ross M'Pherson[72] who was once a strong believer in the section has now recanted, and has stated that "abdominal Cæsarean section has absolutely no place in the treatment of convulsive toxæmia in pregnancy," save when there co-exists a deformed pelvis or other serious cause of disproportion; he prefers conservative treatment. Rossier[89] has done the abdominal section in the case of a woman very anxious to have a living child when the eclampsia was complicated by accidental hæmorrhage; he was happy in being able to congratulate the patient and himself upon a success. Kellogg[54a] looks at the matter from the point of view of saving the child; he is not impressed; he would rather try to save the mother to bear future infants than give her the extra risk of the Cæsarean section in order to save what is very likely a toxæmic child. Bar[5] states that the Cæsarean section has given deplorable results in eclampsia; the indication is a very rare one. Essen-Möller[35] would do it only if the vaginal Cæsarean section presented difficulties, and Ipsen[52] only if the woman were too feeble or her vagina too narrow to allow the vaginal operation. Schumann[94] thinks there are a few cases in which eliminative measures fail, in which there is a small, rigid, long, and undilated cervix, and no labour going on, and in these cases he would do the abdominal section. Brodhead[12] would restrict the operation to primiparæ at or near term with the cervix closed; J. C. Edgar[32] makes similar restrictions and postulates also profound toxæmia; Rongy[88] thinks it has a definite place in the treatment of eclampsia, especially when one has regard to the life of the child, but the woman must not be in labour, she must have reached the 36th week of pregnancy, the cervix must be thick and long, and she must show no response to medical treatment; and Skeel[97] presupposes a long and rigid cervix and a mature child. Beck[7] says with a sharp note of regret: "Unfortunately I considered eclampsia in a primipara with an undilated cervix as an indication in a case with the result that the death of the patient gave me my only maternal mortality in 37 consecutive operations." James A. Harrar[44] has never done a

Cæsarean section for eclampsia; he says "a man who employs Cæsarean section in the treatment of toxæmia or the pre-eclamptic stage with good results is a better surgeon than he is an obstetrician."

Dr Harrar's reference to the *pre-eclamptic* stage raises the question whether the Cæsarean section should ever be employed then before convulsions have occurred. J. W. Poucher[84] thinks that it should. He would do it in primiparæ with long rigid cervices not waiting for fits to develop; and he has done it in seven mothers and has saved them all and their eight babies (one was a twin pregnancy). In five other patients who had developed bad fits he saved only one mother and none of the children. Some of these, however, seem to have been vaginal sections. Arnold Jones[55] holds somewhat similar views.

Notwithstanding some marked exceptions the general tendency at the present time is to pass away from the Cæsarean section as the ideal treatment for eclampsia, and, should adequate supervision of pregnancy and medical measures in the pre-eclamptic state prove useful, this tendency will become still more marked up to the degree of abandonment. Much depends, of course, on the discovery of the real cause of eclampsia; should it be established that it is something formed in the fœtus or placenta, the arguments for the rapid emptying of the uterus will be reinforced and Cæsarean section and other operative measures will again come to the front. The reviewer has not done a section either for the pre-eclamptic state or for eclampsia, for he holds firmly to the dictum that the fits and the toxæmia should be treated and the pregnancy left alone.

Rare Indications for Cæsarean Section, and Rupture of the Scar.

What may be called pelvic causes still form by far the most frequent indications for Cæsarean section. The contracted pelvis still figures first in all lists of causes for operation. Even amongst these pelvic causes, however, some are sufficiently uncommon as to be denominated "rare." The generally contracted, the simple flat, and the rickety flat pelvis account for the vast majority of Cæsarean sections, and amongst the rarer conditions may be placed the Robert pelvis, the achondroplasiac, the coxalgic, and the obliquely contracted. In this country, too, osteomalacia must be regarded as a very rare indication for the section. This, however, is not the case in other countries as in Kashmir. Neve,[77] for instance, has since 1915 done 38 Cæsarean sections for the osteomalacic pelvis. In 16 of these cases there was no definite infection, and none of the mothers died although there were three infantile deaths; in 22 there were definite signs of infection, and in this series there were five

maternal and five infantile deaths (about 23 per cent.). As Dr Neve puts it, "38 operations saved 62 lives," and he adds, "the craniotomy of a living child is little short of homicide." It is truly so, but the profession has beguiled itself by calling it "therapeutic fœticide" or "justifiable homicide."

It is amongst the non-pelvic causes calling for Cæsarean section that the rare indications are found; and it is amongst them also that the non-recurrent indications are mostly found. To some of these, *e.g.*, placenta prævia, accidental hæmorrhage, and eclampsia, attention has already been directed. Their non-recurrent character raises the question whether the dictum "once a Cæsarean always a Cæsarean" holds true. Placenta prævia, for example, may call for Cæsarean section in a primipara; in her second pregnancy there may be no such dangerous situation of the placenta, will it be permissible to allow labour to occur unaided or must a second section be done? The answer will depend upon the confidence which can be placed upon the uterine cicatrix standing the strain of pregnancy and labour. The whole matter has been ably elucidated by Eardley Holland[46, 47] in a conjoint investigation in which 1089 Cæsarean sections were studied. It was found that rupture of the Cæsarean section scar occurred in subsequent labour or pregnancy (excluding abortion) in 4 per cent. of the cases dealt with. The chief cause was found to be a defect in the scar from imperfect healing due mostly to infection of the wound. The cicatrix was discovered to be thin and to consist of peritoneum, decidua, and a varying amount of intervening fibrous tissue; muscular union had failed. Contributory causes of rupture were intra-uterine tension from overdistension of the uterus, powerful contractions in prolonged or obstructed or even in normal labour, and the insertion of the placenta over the site of the scar. Internal version, the use of hydrostatic bags, and the giving of pituitrin were also instrumental in leading to the accident. A rather unexpected finding was that rupture occurred almost as often in pregnancy as in labour, the proportion being as 3 to 4. Further, it might take place as early as the seventh month, and the transverse fundal incision was specially liable to give way. At first sight it seemed as if the nature of the material used in closing the uterine wound was of great importance, for apparently cicatrices following the employment of catgut gave way nearly three times as often as those in which silk was the suture material. There were, however, possible fallacies in the figures, for in the 1089 sections catgut was used in 731, silk in only 288, and silkworm gut in 70, whilst in a few the materials were conjoined; further, pregnancy did not so often follow the use of silk as of catgut. If one restricted oneself to cases of rupture in advanced pregnancy it was found that about 2 per cent. of the silk wounds and 5 per cent. of the catgut ones gave way. It

emerged later in Sir John Byers' paper, [17] that the catgut employed in most of the cases was chromicised.

If the proportion of 4 per cent. of ruptures is to be looked upon as irreducible in the case of pregnancy following upon Cæsarean section, it will certainly be necessary to reconsider the justifiability of performing the operation in some at least of the indications for which it is now being done, and there may be some warrant for the dictum "once a Cæsarean always a Cæsarean"; but there seems every reason to believe that the employment of greater aseptic precautions and the use of silk instead of catgut will reduce the proportion to something much less than 4 per cent. Reports of cases are now beginning to appear in considerable numbers which go far to re-establish the reliability of the uterine scar in subsequent labours. J. T. Williams [110] has considered delivery by the natural passages after a Cæsarean done for such non-recurrent causes as placenta prævia, eclampsia, uterine inertia, and abnormal presentations, and he is strongly of the opinion that the presence in the uterus of a Cæsarean section scar is not sufficient reason for a repeated section in the absence of other indications; therefore patients who have had Cæsarean section done for a temporary indication (*e.g.*, placenta prævia) may be delivered safely by the natural passages in future labours, it being, of course, always presupposed that the scar has not been septic. Williams, however, thinks that such future deliveries should take place in hospitals, where the expert operator surrounded by the required armamentarium may be found if needed. N. R. Mason [76] has also a strong belief in the sufficiency of the scar. Great stress is laid upon an aseptic wound; but it is at least interesting to note that Minnie W. Bazely [6] has done five second Cæsareans in India on patients who had had the section done in the first instance after being in labour for three or four days, and after being examined frequently by untrained native midwives; in only one of the five did she find any sign of a scar in the uterus. Whitridge Williams [112] met with one scar-rupture in 48 women who had repeated section and in 12 who were afterwards delivered by the natural passages, so he thinks the risk has probably been exaggerated, although at the same time it must not be forgotten and it may be wise not to do sections too often for non-pelvic causes. Grosse of Nantes [42] has reported a case in which a woman had three normal spontaneous deliveries following upon Cæsarean section done for an ovarian tumour; the suture material was linen thread, and some time after the section small abscesses formed in the cicatrix and threads came away; yet the uterus resisted the strain in three confinements. Andérodias [1] has also reported a case in which the Cæsarean section performed for cervical rigidity was followed by a normal labour and a large child; and Potocki [83] has met with a patient who first had two normal labours,

then one of shoulder presentation calling for Cæsarean section, and finally a fourth normal one over which, however, the author exercised strict surveillance lest rupture might occur. Losee,[68] it may be noted, has made an excellent contribution to the knowledge we possess of the anatomy of the uterine scar. A contribution which may be regarded as expressing fairly accurately the modern view-point as regards uterine rupture in labours consequent upon Cæsarean section is that by Couvelaire.[22] He studied fifty pregnancies following upon Cæsarean section in 41 women; two ended in abortion, six in premature labour, and forty-two in labour at term; 6 women had ten subsequent normal labours, 16 had a second conservative section, 20 had a section followed by hysterectomy, and 2 had rupture of the uterus followed by hysterectomy; the cicatrix, therefore, gave way in two cases, but in eighteen other cases there was some thinning of it, and in sixteen it was described as "good." Couvelaire thinks that the risk of rupture or of a thin scar is lessening as time goes on, and he is further of the opinion that through surgical sterilisation and the artificial prevention of conception, subsequent gestations will decrease; his conclusion is that there is still a place for conservative Cæsarean section.

The conclusion to be drawn from a study of the available literature would seem to be that after a Cæsarean section every subsequent labour should take place in a hospital where expert operators can be found. Further, every subsequent pregnancy should be under adequate antenatal supervision. Kickham's observation[57] is a warning to all of the reality of uterine rupture: there were two sections done both for eclampsia, and in the third pregnancy with almost no pain the scar gave way. At the same time there is no need to exaggerate the risks. The better the technique of the section the fewer these risks will be.

Whilst it is permissible to count amongst the rarer indications for Cæsarean section such conditions as heart disease (with decompensation as a rule), ventral fixation, neglected transverse presentation, face cases, occipito-posterior positions, breech presentation in the elderly primipara (Browne[15]), ovarian cysts, fibroid tumours of the uterus, atresia of the cervix, and malignant growths of the uterus and neighbourhood, the following indications must be regarded as extremely rare. Potocki[83] had to perform the Cæsarean section in a case of pregnancy in one half of a uterus didelphys; the unimpregnated half was retroflexed and occupied the pelvis where it caused obstruction; both mother and child did well. Pestalozza[82] and Dougal[29] met with somewhat similar indications. Van Doren Young[113] operated for an unusual combination of indications, viz., contracted pelvis, double uterus, and multiple fibroids; and Stockaert[100] also

dealt with an uncommon conjunction in hydramnios, ascites, and an ovarian cyst with a twisted pedicle wedged into the pouch of Douglas necessitating Cæsarean section. Conaway's exceptional indications[19] were, in two instances peritonitis situated around the appendix vermiformis, and in another retention of the fœtal head after decapitation. An extraordinary cause for the section was found by Brunner[16] in the presence of vaginal varicose veins which made labour through the normal passages too dangerous; one similar case seems to have been reported by Brunet in 1906. The reviewer has seen one patient upon whom induction of premature labour was being attempted who had such marked varicosity of the vaginal veins as to bring her nearly into danger of death from the hæmorrhage; under similar circumstances he would choose the Cæsarean section as safer. Creutz[25] operated for an unusual indication when he performed a Cæsarean for a woman who had on two previous occasions given birth to dead infants, the deaths being due to premature separation of the placenta; in the third pregnancy he anticipated the contingency by the section. One must reckon as still among the rarest indications that founded on the dead-birth of very large infants (mature or more often post-mature) in previous pregnancies. Applegate[2] met with such a case, and the reviewer also did a successful Cæsarean section upon a woman with a rather large pelvis who had previously had infants said to have weighed 14 lb. and 16 lb. born by means of extensive embryulcia. Rongy[88] did a section for a dead fœtus weighing 16 lb. There seems no reason why one should not oftener do the Cæsarean section for large infants; the large child produces a state of matters exactly similar to that caused by the narrow pelvis. Surely one of the most uncommon indications for Cæsarean section was that met with by Licht and Calicchio[66]: a premature female twin weighing $4\frac{1}{2}$ lb. was born first, normally; the second twin was a female acephalic monstrosity, 12 inches long, $6\frac{1}{2}$ inches wide, and $6\frac{1}{4}$ inches thick, for whose extraction abdominal section had to be done.

(*To be continued.*)

LETTER FROM VIENNA.

(*From our own Correspondent.*)

In order that the following outline of the medical societies in Vienna may be clear to a foreigner, some preliminary explanation is necessary.

Like the rest of the population, the medical fraternity in German Austria is split up into parties by nationality, religion, and political conviction. For very many years the medical profession in Vienna has been divided into two great groups: the Aryan and the Jew. To these two parties, who, though they quarrelled as occasion arose, agreed fairly well on the whole especially where questions affecting the common interests of the medical profession were concerned, there has been added since the Peace a third party—the eastern Jews from Poland and Galicia who have taken advantage of the political situation to settle in Vienna. Among them, as might be supposed from their origin, are numerous elements with an oriental bolshevist tendency, and also many who have not a very high standard of professional Morals. In view of all this, it is a very noteworthy manifestation of professional solidarity that, as I mentioned in my last letter, it has been possible to unite, with very few exceptions, all the doctors in Vienna in a comprehensive defence society—the *Wirtschaftliche Organisation der Aerzte Wiens.* To the benefits which have resulted from this union I have already alluded.

If we now turn to the activities of medical societies in Vienna, we have first to distinguish between those whose aims are purely scientific, and those which deal with medical politics and professional interests in the more material sense. Of the first series, the most important and oldest established is the *Gesellschaft der Aerzte*, which is well known beyond the confines of Austria. Membership of this society is restricted to those who have done scientific work. Accordingly admission to the society, though now more easily attained than in the past, is limited to a relatively small number of men—teachers in the University, members of hospital staffs, and assistants in the various departments, as well as a few honorary and corresponding members. The *Gesellschaft der Aerzte* possesses premises of its own, the *Billroth-haus*, with a large lecture hall fully equipped with projection apparatus, in which its weekly scientific meetings, demonstrations of patients, etc., are held. In the building is also housed the valuable library which is the property of the society, and the editorial offices of the *Wiener klinische Wochenschrift* which belongs to the society. The subscription is fairly high, on account of the numerous advantages the society affords to its members. Candidates for

membership, who must be proposed and supported by six members, are elected annually at a general meeting.

As regards other scientific societies, almost every specialty has its own, in which, almost weekly, communications are read and demonstrations given. Admission to these special societies presents no difficulty, and the meetings, which are well attended, usually take place in the lecture rooms of the various special departments.

An old established society, at which scientific subjects are discussed, but which is chiefly concerned with the professional interests of its members, is the *Wiener Medizinische Doktoren-Collegium*, which in former times had a semi-official status. It maintained three benevolent institutions for its members—a widows and orphans society, a pensions institute, and a charity institute—and gave numerous grants to students and doctors. In pre-war days it was a wealthy body, but has been greatly impoverished by the depreciation of money in Austria. Two other benevolent societies for medical men and their dependents have also suffered from the same cause, for it is not feasible, medical incomes being what they are, to raise the subscriptions to such societies to a lure which will admit of adequate benefits being paid.

A very large association with branches all over the country, the membership of which is restricted to Aryans, is the *Verein deutscher Aerzte in Oesterreich*. Its objects are partly scientific and partly political; associated with it there is a savings bank which makes advances to members, and it publishes a paper, the *Aerztliche Reform Zeitung*. There are also in Vienna local unions which are sections of the *Wirtschaftliche Organisation* aforesaid, and form channels of communication between individual doctors and the President of the organisation. These local unions (*Bezirkssektione*) play a very important part in the doctor's daily work, because they act as agencies for the supplying of heating materials and other necessities of life which the doctors think necessary in their welfare work.

There are further various special medical societies—Jewish, Christian, musical, orchestral, and official, whose activities require no further mention.

Whether the truce with the Government and the parties in the National Assembly, to which I alluded in my last letter, will continue and culminate in an enduring peace, is not yet certain. The present Government does not seem to be lacking in good will towards the doctors. They have, for example, introduced a new Bill for regulating medical practice (*Aerzte ordnung*) in which the principal demands of the profession appear to be incorporated. It now remains to be seen whether the measure will pass the Chamber in a form acceptable to the medical profession. The question of the Profits tax (*Erwerbs steuer*)

is a very difficult one. This is a tax which must be paid, in addition to income tax, by every one who pursues any occupation for gain. As this tax pressed very heavily on the doctors, one of their demands was that they should be exempted from it. This the Government refused, on the ground that legislation would be required, but they have promised that the tax would be made less burdensome. As regards reform of medical education, here again the wishes of the doctors have been taken into account, though it must be admitted that on one point, a compulsory year of hospital work after the conclusion of the students' curriculum, there is no unanimity of opinion among the doctors themselves. The new Health Ministry is to be re-constituted in accordance with the wishes of the profession.

NEW BOOKS

General Pathology. By HORST OERTEL, Professor of Pathology in M'Gill University. Pp. xxi + 357. New York: Paul B. Hoeber. 1921. Price $5.00.

Professor Oertel's book is intended as an introduction to the study of pathology, and as such it should serve admirably if suitably accompanied by lectures and demonstrations. The author recognises the great tendency that exists for the student to treat each subject of his course as a water-tight compartment, and to separate what he has learnt in his biological and physiological studies from his work in pathology. This attitude is largely due to the view that special vital forces are at work in pathology. He bridges the gap by emphasising that pathological processes are physical and chemical cell alterations and disturbed cell relations which follow common biological laws; and in the majority of cases, at least, find a definite anatomical expression. He also considers it of great importance to trace the history of our knowledge of various problems in order to show what influence each step of thought has exerted on the next.

The first half of the book is devoted to the causes of disease. The harmful effects of physical and chemical agents are shortly dealt with, and a considerable space is occupied with an account of the commoner bacteria. Immunity, heredity, disposition, and idiosyncrasy are simply and lucidly discussed in this section.

Pathological anatomy, histology, and pathogenesis occupy the second part of the volume. The chapters on retrogressive and progressive changes, disturbances of metabolism and of the circulation are good, but the account of inflammation seems rather too brief, while the subject of tumour growth has been too generously treated.

Notes on the Medical Treatment of Disease. By R. D. RUDOLF, C.B.E., M.D. (Edin.), F.R.C.P. Pp. 457. University of Toronto Press. 1921. Price 25s.

The present volume makes no exhaustive review of therapeutics, but is an attempt to impress upon the reader the broad principles of medical treatment. Throughout the book the author emphasises the fact that the patient ought to be treated as an individual, and not merely as a "case" of this or that disease. The first two chapters are devoted to introductory remarks which cover a wide range of subjects and contain much sound advice. For example, the young practitioner is counselled to keep two years behind the times as regards the adoption of new forms of treatment in his

practice. Various fevers and certain general diseases are dealt with in the earlier part of the book, and later the discussion of other diseases is taken up under the system which they affect. Under each subject are a few remarks on pathology and diagnosis which may be necessary to understand what follows. The resources of the physician are then described under the headings of environment, diet, specific treatment, and symptomatic treatment. Minor ailments, which form such a large part of general practice, are as carefully discussed as the graver diseases. Reasons for employing each drug are given wherever possible, but the author does not hesitate to recommend a helpful drug though its use be empirical. There is a chapter on the therapeutic use of oxygen, and another on the present position of venesection. Professor Rudolf sums up his views in the sentence—"In many cases venesection is the most powerful method of treatment at our command." The book is a most readable production, and we anticipate that it will become a great favourite with the final student and the young graduate.

A Physical Interpretation of Shock, Exhaustion, and Restoration. By GEORGE W. CRILE. Pp. 232, with 120 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price 25s. net.

In this volume Dr Crile embodies the results of a vast amount of research carried out in his laboratory and clinic at Cleveland, and during his period of war service in France. His later researches are in continuity with his well-known previous work on shock and restoration. All available causes of exhaustion and shock have been tried experimentally, and the phenomena of exhaustion have been investigated in almost every conceivable way.

While the results of group experiments have been summarised and discussed, the details of individual experiments are sufficiently described and illustrated to permit the reader to draw his own conclusions. Perhaps most interest will be aroused by the observations on the alteration of the electrical conductivity of the brain and liver, and their significance in shock, and by the description of the histological changes in the brain cells which result from over-stimulation from different causes, such as, trauma, anæmia, infections, excessive physical exertion, prolonged insomnia, etc. Whether Dr Crile's explanation of the mechanism of shock and its inception is correct in every detail will be settled by time. In support of his views he is able to show not only a great deal of experimental evidence but also practical results, in the diminution of surgical shock and of the mortality rate of major operations, achieved by the application of his theories to surgical practice.

NOTES ON BOOKS

Binnie's *Manual of Operative Surgery* (H. K. Lewis & Co. Ltd., price £3, 3s.), which now appears in its eighth edition, does not call for detailed notice. This work has established itself as a standard source of reference, and is, or should be, on the table of every operating surgeon. Special attention is given to the more complicated and difficult operative procedures, and these are described in such detail as to enable the young operator to follow the steps with precision. In most cases alternative methods are described and commented upon so that a choice may be made to suit the case in hand. In the present issue the chapter on War Surgery has been omitted, but the surgical lessons learned during the war are incorporated throughout the text. The chapters on thoracic, abdominal, and plastic surgery have been practically rewritten, and although all the most important advances in operative technique are included in these, as in other sections, the volume is no larger than its immediate predecessor. The illustrations, which are numerous, are of unequal merit and suffer from the lack of explanatory legends.

The *Text-book of Pathology*, by Alfred Stengel and Herbert Fox (W. B. Saunders Company, price £2, 2s.), is already well known in this country, and in its seventh edition presents to the student and practitioner a comprehensive view of modern pathology. The text has been thoroughly revised and much of it rewritten in the light of advances in knowledge made since the previous issue was set. The microscopic illustrations are good—the naked-eye ones less satisfactory.

It is not necessary to do more than record the appearance of a new edition—the 12th—of *Materia Medica and Therapeutics*, by Dr Mitchell Bruce and Dr W. J. Dilling (Cassell & Company, Ltd., price 10s. 6d. net). Retaining all the recognised qualities of previous editions, the latest issue includes much new matter in the sections dealing with vitamins, vaccines, mineral waters, and invalid diet, as well as a short summary of the provisions of the Dangerous Drugs Act, 1920.

Sir James Mackenzie's *Symptoms and their Interpretation* is so well known and so highly valued that we need not do more than chronicle the appearance of a fourth edition (Shaw & Sons). It is a clearly defined endeavour to find the laws governing the production of symptoms in disease and to guide research along better lines. The author points out that the line of advance lies not in the finding of new symptoms, but in the understanding of those we already know, not only as to their causation but also as to the indication they give of the

future course of the patient's complaint. The symptoms occurring in the affections of the alimentary, pulmonary, and cardiac systems all receive consideration, and as an appendix the "Theory of Disturbed Reflexes in the Production of Symptoms of Disease" as recently published is included.

In the preliminary chapters of *The Early Diagnosis of the Acute Abdomen* by Zachary Cope, M.D., F.R.C.S.Eng. (Henry Frowde and Hodder & Stoughton, price 12s. 6d. net), the author deals with the principles of diagnosis in acute abdominal cases. His case form for the taking of a history of these cases is given, and the various signs and symptoms that may occur are discussed with a view to making a definite diagnosis. In the succeeding chapters those acute conditions requiring operation are dealt with in turn, considerable space being devoted to the Appendix. The diagnosis of abdominal injuries, the acute abdomen in the Tropics and various conditions which simulate the abdominal emergencies are also included. There is a tendency for the subject-matter of the different chapters to overlap, but the volume is quite a practical one, and should prove useful to those who have to diagnose this type of case in its earliest stages.

The Anatomy of the Human Orbit and Accessory Organs of Vision, by S. Ernest Whitnall (Henry Frowde and Hodder & Stoughton, price 35s. net), is primarily intended for the ophthalmologist, but will appeal also to the general anatomist as a regional study. It deals very completely with the anatomy of the orbit, and is divided into three sections headed "Osteology," "The Eyelids," and "The Orbital Contents." A description of the accessory sinuses of the nose is included, and there is an appendix on the cerebral connections of the nerves. The author has produced a clear and well-written book, full of points that are of great practical importance to the surgeon. The illustrations, nearly all photographs of actual dissections, are well chosen and excellently reproduced.

In *Local Anæsthesia in Dental Surgery* Mr Norman Black, L.D.S.Eng. (John Bale, Sons, and Danielsson, Ltd., price 5s. net), has succeeded in his desire to advance the sphere of usefulness of local anæsthesia on dentistry, and has given a description of the anatomy necessary for the scientific application of the technique which he recommends to be followed by those who would avail themselves of the more recent developments of the subject. The book contains much useful advice and is illustrated with helpful diagrams.

BOOKS RECEIVED

AARON, CHARLES D. Diseases of the Digestive Organs. Third Edition
(*H. K. Lewis & Co., Ltd.*) 50s.

CUMSON, CHARLES GREENE, and G. PATRY. The Surgical Treatment of Non-Malignant Affections of the Stomach
(*Wm. Heinemann (Medical Books) Ltd.*) 15s.

EDMUNDS, WALTER. Exophthalmic Goitre (*Baillière, Tindall & Cox*) 3s. 6d.

EMERSON, CHARLES PHILLIPS. Clinical Diagnosis. Fifth Edition.
(*J. B. Lippincott Company*) 35s.

FIOLLE, J. and J. DELMAS. The Surgical Exposure of the Deep-seated Blood-Vessels . . . (*Wm. Heinemann (Medical Books) Ltd.*) 8s. 6d.

GROSS, LOUIS. The Blood Supply to the Heart . . (*Paul B. Hoeber*) $5·00

GUY'S HOSPITAL REPORTS. Vol. LXXI. No. 4
(*Oxford Medical Publications*) 12s. 6d.

HAWK, PHILIP B. Practical Physiological Chemistry. Seventh Edition.
(*J. & A. Churchill*) 24s.

HEWER, Mrs J. LANGTON. Our Baby. Seventeenth Edition
(*John Wright & Sons, Ltd.*) 2s. 6d.

KING, D. BARTY. Studies in Influenza . . . (*J. & A. Churchill*) 7s. 6d.

KIRKPATRICK, H. Cataract and its Treatment
(*Oxford Medical Publications*) 12s. 6d.

KRAMER, JOHN B. Radiations from Slow Radium
(*Baillière, Tindall & Cox*) 12s. 6d.

LANGLEY, J. N. The Autonomic Nervous System. Part I.
(*W. Heffer & Sons, Ltd.*) 5s.

MOYNIHAN, Sir BERKELEY. Essays on Surgical Subjects
(*W. B. Saunders Co., Ltd.*) 25s.

PEARCE, E. K. Typical Flies. Second Series
(*Cambridge University Press*) 15s.

DE SCHWEINITZ, GEORGE E. Diseases of the Eye. Ninth Edition
(*W. B. Saunders Co., Ltd.*) 50s.

SORAPURE, VICTOR E. Edited by. The Oxford Index of Therapeutics
(*Oxford Medical Publications*) £2, 2s.

STELWAGON, H. W. Diseases of the Skin. Ninth Edition
(*W. B. Saunders Co., Ltd.*) 50s.

WALMSLEY, THOMAS. A Manual of Practical Anatomy. Part II.
(*Longmans, Green & Co.*) 10s. 6d.

WILDE, PERCY. The Physiology of Gout, Rheumatism, and Arthritis
(*John Wright & Sons, Ltd.*) 12s. 6d.

WILDER, R. M., M. A. FOLEY, and DAISY ELLITHORPE. A Primer for Diabetic Patients . . . . . (*W. B. Saunders Co., Ltd.*) 7s. 6d.

WILSON, R. M. Early Symptoms and Treatment of Circulatory Disease
(*Oxford Medical Publications*)

WOOD, Sir KINGSLEY. Dental Registration (*Baillière, Tindall & Cox*) 5s.

Edinburgh Medical Journal

February 1922

EDITORIAL NOTES

The Professional Examinations.

THAT some test of the scientific and technical capacities of an aspirant to the profession of Medicine is essential before he is licensed to practise need not be argued. The safety of the public, the credit of the profession, and the interests of the would-be doctor himself alike demand it.

It is not so clear, however, that our present system of "Professional Examinations" is that best calculated to attain the object in view. As at present arranged the professional examination for a qualifying degree consists of four divisions: the first, including Chemistry, Botany, and Zoology; the second, including Anatomy and Physiology; the third, Pathology, Materia Medica, and Therapeutics; and the fourth and final, Forensic Medicine, Public Health, Surgery, Medicine, and Midwifery.

We are not at present concerned with the order in which these various subjects are taken in the examinations (although that might be criticised); it depends on the arrangement of the curriculum, and as that at present stands it is the natural sequence. Some re-adjustment of the curriculum is, we understand, at present under consideration, and such improvements as are made will doubtless be reflected in the examinations.

Our immediate concern is with the system which constitutes the formal professional examination, the sole test of the student's capacity to proceed to a further stage in his studies, and ultimately to become legally qualified to practise his profession.

If we take, for example, the first division of the examination, we find that a student, after studying the subjects of Botany and Physics for a single term of ten weeks, may appear for examination immediately thereafter, and if he passes (as the majority of candidates do), his education on these subjects is completed. He receives no further instruction on them, and his knowledge is not again tested. But this is not all;

the examination may be immediately followed by a long vacation of from eight to ten weeks, a period which gives ample time for such knowledge of the subjects as had been acquired to evaporate, or even for the information that had been gathered to be forgotten. It is probably safe to say that not one in ten of the candidates who pass the examination at the end of the summer term could do so again at the end of the long vacation without further preparation.

If the Professional Examination must remain the official test, it would be better to postpone it until the end of the vacation, and so afford time for assimilation of what has been taught in class and for private study. A wider, deeper, and more permanent knowledge of the subjects would thus be acquired, and, incidentally, some intellectual employment that might not be without value to a youth of eighteen would be provided for what is an unduly generous holiday after ten weeks of work.

Similarly, the examinations on Chemistry and Zoology are held as soon as the courses of instruction are completed, and if the student passes he tacitly assumes that he is done with these subjects, and ceases to be interested in them. This frame of mind on the part of the student is largely due to the exaggerated importance that is laid on "Professional Examinations" both by the authorities and by the candidates. To the student each professional is a milestone on his journey, and in some cases a milestone with a barred toll-gate beyond; all his energy is directed towards passing it, and if that can be attained more surely by cramming than by study, then he crams. Other subjects that should be sharing his attention, but do not come within the professional examination immediately ahead, are meanwhile neglected. The test is not a natural one. The student is in a state of nervous tension, constantly looking for traps (which really are not there), and generally is so perturbed that he is unable to exhibit such knowledge of the subject as he may possess. Nor, be it confessed, is the examiner always quite normal during these days of what is really very strenuous work. Moreover, success in the examination does not mark the termination of study of the subject—although the certificate "passed in ——" may naturally suggest to the student that it does.

Our plea is that a fairer estimate of the student's proficiency would be obtained by periodically testing his work and knowledge during his course of instruction than by formal professional examinations. Throughout the course each member of a teaching unit—professor, assistants, demonstrators, and tutors—should make careful observations of the student's progress and record the results. What we adumbrate is something more searching and more personal than the existing class examinations. It should not consist merely of written examinations (these indeed should be quite subsidiary), but should be based upon

personal observation by the teacher of the care and skill with which practical work is done, and upon tests by question and answer in the course of the class work. If such records were collated at the end of the term it would not be difficult to grade the members of a class in order of merit. Further, it is desirable that the Class Certificate granted should indicate the degree of proficiency attained by the student, and not merely that he "duly performed the work of the class." The accepted sobriquet of "D.P." sufficiently indicates the value the student attaches to his class certificate.

In subjects the study of which extends over a number of terms, like anatomy, physiology, and the clinical subjects, the argument against examinations immediately after the completion of the course has not the same force, but the advantage of the class-record system of testing is all the greater, as there are wider and more varied opportunities of applying it. The method has the further advantage that it encourages the student to concentrate on the subject in hand for its own sake, rather than to devote his energies towards cramming for an artificial test in the form of a professional examination.

In this connection it is satisfactory to note that the General Medical Council has accepted the principle "that the work of the student throughout the whole curriculum, if suitably tested and recorded, might be taken into consideration as an important element in the assessment of the marks awarded in the professional examinations."

For some years tentative experiments have been made in certain classes in the Edinburgh School in applying this method, and the results obtained have been found to aid materially in the assessment of candidates at professional examinations. Those who have made the experiment have been struck also by the effect it has had in the quality of the student's class work. The knowledge that he is receiving credit for what he does in class acts as a healthy stimulus and sustains his interest throughout the term.

It has been suggested that the principle of taking class records into consideration in assessing candidates for pass examinations would not be applicable in the case of students who study at one school and appear for their professional examinations at another, or before a non-teaching Board of Examiners. This difficulty would be got over, or at least minimised, if all teaching bodies were to adopt a method of grading their students on a uniform standard, and grant certificates bearing the grade of efficiency reached by the student. It may be argued that no process of grading would be equitable, as no two schools or no two examiners would adopt precisely the same standard for the purpose. This is doubtless true, but the same argument applies to individual examiners on different Examining Boards, who at present conduct qualifying examinations.

A simple method would be to recognise three grades: *Grade A.* for students who obtain say, 70 per cent. or more in the Class Tests; *Grade B* for those between 60 and 70 per cent.; and *Grade C* for those between 50 and 60 per cent. Thus a candidate whose certificates showed that he had consistently been in Grade A in all his classes in the department of (say) medicine—systematic, clinical, tutorial, and in the different allied specialities—would receive due credit for this in the final examination; while another who had never got beyond Grade C would be dealt with accordingly.

The recognition by the General Medical Council of the principle that class work shall count in qualifying examinations is a great step forward, and we cannot doubt that if it is judiciously developed and extended, not only can a more reliable test of the student's proficiency be evolved, but the change will make for greater efficiency in teaching and for more concentrated study on the part of the student.

University of Edinburgh—Graduation Ceremonial.

At the Graduation Ceremonial held on 16th December 1921, the Vice-Chancellor conferred the following degrees:—*Doctor of Medicine.*—Garth Ap Thomas, John J. R. Binnie, Alice Bloomfield, Cecil Brown (*Commended for Thesis*), S. B. Boyd Campbell, Vincent T. Carruthers (*Highly Commended for Thesis*), Alexander G. Coullie (*Commended*), Francis A. E. Crew (*Commended*), Herbert R. B. Gibson (*Commended*), Robert L. Girdwood (*Commended*), George H. Gunn, Gustav Lange, David Lennox, John S. Lloyd, Benzion Morrison (*Commended*), Hubert Patley, Ella F. Pringle, Richard H. Pulipaka, Andrew O. Ross, Joseph H. Sandison, Herbert J. Slane, Arthur K. Towers.

Bachelor of Medicine and Bachelor of Surgery.—Reuben Abramsky, John C. Adam, Cecil S. Appleyard, Elias Arosemena, Charles G. Auld, Charles T. B. Benson, Lionel R. Bergson, Susan A. Binnie, John M. Blair, Roger P. Bliss, John M. Bonar, George Brewster, Agnes G. Brough, Douglas L. Brown, Charles Brownlee, William S. Burr, Karl F. Caird (*with Second Class Honours*), Arthur Campbell, Donald Campbell, George G. Campbell, Charles G. Catto, Clarence H. F. de Chalus, Edwin Clark, Donald R. Clarke, Matilda L. Craig, Douglas R. Cramb (*with Second Class Honours*), John C. Cruickshank, Alexander H. Deighton, John A. Douglas, Alexander M. Duff, Jeannie P. Dunn, Katrine Dunn, Evelyn B. Ewen, Gordon B. Flint, Charlotte E. Forsyth, John A. Fraser, Eileen R. Freeman, Frederic L. A. Gacé, Marjorie Geen, Owen S. Gibbs (*with Second Class Honours*), Norris Giblin, Doris M. Gibson, Helen E. Gibson, Andrew R. Gilchrist, Ion S. Hall, Thomas Harrison, Isabella M. Hay, William B. Hughes, Elspeth J. Hunter, Richard H. R. Innes, Barnett Isaacson, Inez Mary Y. M. Jenkins, Charles Irvine-Jones, Joseph O. Kelly (*with First Class Honours*), Marjorie C. Kerr, Arthur King, Johan

Lovius, Patrick J. M'Diarmid, Jane W. Macdonald, William S. Macdonald, George S. Mackay, George W. J. Mackay, John C. MacKay, Henry D. M'Kinna, Herbert M'Nair, John W. Mason, Donald S. Middleton (*with Second Class Honours*), Ian C. Middleton, Ann L. Morrison, Quazi M. Musa, Stanley S. Nicholson, George Ogilvie, Montague M. Ostrowick, James W. T. Patterson, Harry R. Potter, Alexander M. W. Rae (*with Second Class Honours*), Louis Ratnayaké, William B. Reid (*with Second Class Honours*), Charles A. Robson, Abraham Sanders, Ernest L. Sanders, Gerald G. Sanders, Margaret M. Sands, Manmatha N. Sanyal, Gordon S. Scott (*with Second Class Honours*), Charles M. Seward, John M. Slater, Allen T. Sloan, Thomas R. C. Spence, George D. Steven (*with Second Class Honours*), Francis M. Stewart, Alexander Stuart, Alister Sutherland, Arumana K. Tampi, Marion C. Taylor, Lewis Teitelman, David W. Tough, George A. Velluot, Kakumanu Vullakki, George B. Walker, John Walker, Peter K. Walker, Sarah B. Walker, Kenneth B. Williamson (*with Second Class Honours*), Arthur J. Wilson (*with Second Class Honours*), John T. Wilson, John H. Wright.

The Diploma in Public Health.—William P. S. Johnson, M.D.

Royal College of Surgeons of Edinburgh.

At a Meeting of the College held on 16th December, the eighteen successful candidates, out of sixty-eight entered who passed the requisite examinations in October 1921, were admitted Fellows Ennis R. Chambers, M.R.C.S. Eng.; Cecil B. Clarke, M.R.C.S. Eng.; Jacob H. Dove, M.B., Ch.B. St And.; Ernald D. Smith, M.D. Edin.; V. B. Gokhale, M.R.C.S. Eng.; John W. Hall, M.D. New Zeal.; Norman Hodgson, M.B., B.S., M.S. Durh.; Earnest W. Ingle, L.R.C.S.E.; M. S. Irani, L.R.C.S.E.; V. M. Kaikini, M.B., B.S. Bombay; Robert Mailer, M.B., Ch.B. Edin.; Robert B. P. Monson, M.D. New Zeal.; K. S. Nigam, M.D. Allahabad; Arthur L. Sheppard, M.B., B.S. Durh.; Phineas A. Smuts, M.R.C.S. Eng.; David Steven, M.D. New Zeal.; Robert L. Stewart, M.B., Ch.B. Edin.; Thomas J. R. Warren, B.A.O., M.B., B.Ch. Rotunda.

Dr George Mackay and Mr Charles Walker Cathcart, C.B.E., have been re-elected Representatives of the College on the Board of Management of the Royal Infirmary, Edinburgh, for the ensuing year.

Post-Graduate Instruction.

The Fellowship of Medicine and Post-Graduate Medical Association have arranged a Special Post-Graduate Course in General Medicine to be held in London between 9th January and 18th February 1922. Members of the staffs of fourteen different hospitals are taking part in the course, and a very comprehensive syllabus has been arranged.

A NOTE ON ASTHMA: ITS PATHOLOGY AND TREATMENT.*

By J. J. GRAHAM BROWN, M.D., F.R.C.P. Edin., Consulting Physician, Royal Infirmary of Edinburgh.

CONTENTS.

Nuclei of vagus, *p.* 54
Functions of afferent fibres of vagus, *p.* 56
Their regulation of respiratory movements, *p.* 57
Efferent vagal neurones, *p.* 59
Their influence on smooth bronchial muscle, *p.* 59
Results of direct experiment, *p.* 60
Reversal effect, *p.* 61
Clinical results of bronchial spasm, *p.* 61
Reflex causes, *p.* 62
Sympathetic inhibition, *p.* 62
Vagal hypertonus, *p.* 63
Anaphylaxis as a cause of asthma, *p.* 65
Mode of production, *p.* 66
Nature of anaphylactic shock, *p.* 66
Varieties of proteins at work, *p.* 66
De-sensitization, *p.* 68
Treatment of anaphylactic shock in Man, *p.* 69
Treatment of asthma, *p.* 69
1. by reversal effect, *p.* 69
2. by paralysing myoneural junctions of vagal neurones, *p.* 70
3. by inhibition, *p.* 70

THE whole subject of asthma—its causation, pathology, and treatment—as well as certain of the problems of sensitization, are intimately related to the functions and reactions of the afferent neurones of the vagus, and more especially of the efferent. So much is this the case that without a reasonable knowledge of these vagal activities, the symptoms of the disease both in its pure form and when it is complicated with bronchitis, cannot be clearly understood. This observation applies even to a greater degree when we are considering the rational lines on which treatment should proceed.

So far as the motor innervation of smooth muscle is concerned, much the most important bulbar neurones are those whose axones run in the vagus, and which are joined by the fine fibres of the spinal accessory nerve. All these neurones belong to the para-sympathetic system.

It is a matter of common knowledge that the vagus sends motor fibres to striated as well as to unstriated muscles, and a short statement may here be made as regards the various nuclei of that very important nerve. The beautiful investigations of Molhant (1) have made it clear, in the first place, that the Nucleus ambiguus is the motor centre for such striped muscles of the pharynx and larynx as are innervated by the vagus and

* Received for publication, 10th December 1921.

for these only. The large multipolar cells of that nucleus are clearly motor and are similar to those of the anterior horn of the cord. The Nucleus ambiguus belongs to the same system, embryologically, as the nucleus of the 7th cranial nerve and the motor nucleus of the 5th.

The nature of the dorsal nucleus of the vagus is a much more difficult question and one on which opinion is divided (2) (3) (4). The probability seems to be that it is in part receptive and in part emissive, neurones connecting it for the latter purpose with the Nucleus ambiguus.

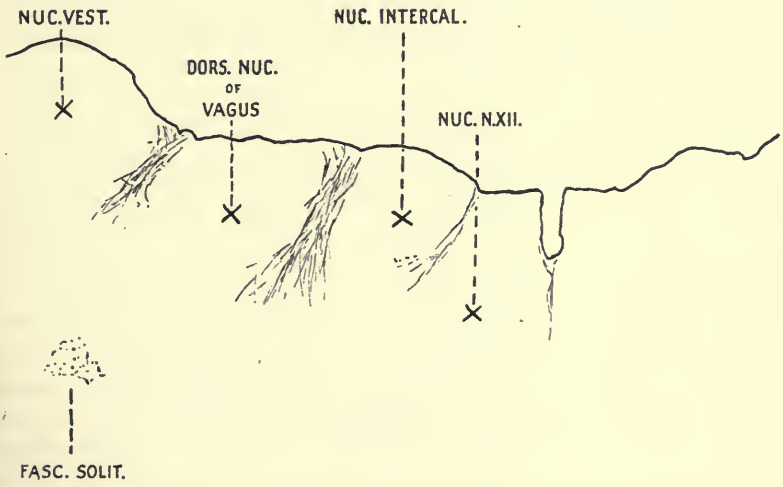


FIG. 1.—Position of Nuclei in Floor of Fourth Ventricle (*after Streeter*).

But in so far as concerns the efferent vagal neurones belonging to the para-sympathetic system, what we have to consider is a nucleus of a different character, namely, the Nucleus intercalatus of Staderini (5). This group of small cells, closely resembling in appearance those of the intermedio-lateral tract in the cord, lies superficially in the floor of the 4th ventricle, except at its upper end where it is crossed by the Striæ medullares.

According to the careful investigations of Streeter (6), the Nucleus intercalatus measures in length about 11 mm. and in its greatest width 2·2 mm. Broadest at the ventral end where it lies between the vestibular nucleus and the nucleus funiculi teretis, it gradually tapers caudally, becoming intercalated

between the dorsal nucleus of the vagus and the hypoglossal nucleus ([7]).

From the cells of this Nucleus intercalatus, then, arise the axones which go to innervate all the smooth muscles and the glands controlled by the vagus. Some have held ([8]) that these neurones have a synapse in the ganglion nodosum. This would not be consonant with the general arrangement of the parasympathetic system, and more recent observations go to show that such synapse does not occur ([9]). Axones, anatomically and physiologically continuous, conduct stimuli descending the vagus to the pulmonary and cardiac plexuses and to those of the œsophagus, stomach, small intestine, and neighbouring viscera. With cells in these plexuses, homologues of the plexus of Auerbach, the efferent vagal neurones come into synaptic relation.

It may be useful at this point to outline the general nervous and muscular arrangements by means of which respiration is maintained. As is the case with regard to the heart there is here also an automatic mechanism which works independently, at least to some measurable extent.

In the movement of the thorax by which inspiration is normally carried out, many striated muscles are engaged—the diaphragm, the intercostals, the serratus, and so on. Clearly these must act in complete harmony if the combined movement is to be effective. Afferent stimuli are therefore necessary for purposes of co-ordination, and these consist in proprioceptive impressions from the muscle-spindles and tendon-organs of Golgi. I have discussed the nervous mechanism of co-ordination in former papers ([10]).

The co-ordination necessary for such harmonious action takes place, in part at least, in the respiratory centre to which these afferents pass. This vital centre lies in the Medulla about the level of the calamus scriptorius, and we may reasonably assume with Cajal and with Ranson ([11]) that its cells are situated at the lower end of the nucleus of the solitary fasciculus. The path by which the efferent stimuli reach the various motor nuclei of the anterior horn lies in the lateral column of the cord—the solitario-spinal tract. The reflex arc is thus constituted, and by its activities the combined action of the numerous muscles engaged in the act of inspiration is rendered smooth and harmonious.

The respiratory centre governing this finely co-ordinated

action, whatever its exact localisation may be, is in any case in close association with the nucleus of Staderini and with afferent fibres of the vagus. The para-sympathetic control of respiration is thus provided for, but, before we proceed to study that mechanism, something must be said regarding the chemical regulation of the act of breathing.

The stimuli passing round the reflex arc just mentioned—muscle-spindle: afferent neurone: respiratory centre: neurone to anterior horn cells: motor neurone to muscle (the final common path, as Sherrington calls it)—while indispensable for purposes of co-ordination, are not sufficient of themselves to maintain rhythmical breathing. Further stimuli are therefore necessary, and the importance of maintaining a proper oxygenation of the blood is so vital to the organism that the automatic regulation of the respiratory centre is arranged with quite extraordinary delicacy. This centre is so constituted as to be exceedingly sensitive to even the slightest variations of the H-ion concentration in the blood which bathes it, this depending among other factors on the CO_2 tension in the alveolar air. We owe the exactitude of our knowledge on these points very largely to the laborious researches of J. S. Haldane and his pupils. The whole question of the chemical regulation of breathing, of acidosis, and of the means by which H-ion concentration in the blood is regulated, has been described recently by Haldane ([12]) in some detail. It is to be remembered that the linking-up of the vagal neurones with the respiratory centre ensures that the frequency and the depth of the respiratory movements shall be harmoniously adjusted.

The para-sympathetic neurones of the vagus, one of whose great functions it is to protect the heart from over-strain, perform a similar protective action with regard to the lungs; and in considering the function of the respiratory fibres of the vagus it is to be remembered that both afferent and efferent fibres are thus engaged.

As regards the afferent fibres of the vagus it has been known for long that stimulation of the uncut nerve or of its central end produces changes in the respiratory rhythm. The work of Hering and Breuer ([13]) showed that a reflex regulation of respiration was one of the functions of these neurones, inflation of the alveoli causing a stimulus to pass to the respiratory centre which inhibited further inspiratory effort, while deflation stimulated the centre to produce that very effect. This most in-

teresting automatic regulatory mechanism was subsequently investigated by Head ([14]), who, like Breuer, worked in Hering's laboratory.

It is thus evident that one important function of the vagus is to regulate the depth of the respiration and to save the lung from over-distension, just as another vagal function saves the heart from straining against too high blood pressure. Also it seems clear that the respiratory centre has two distinct functions, inhibitory and excitory, upon which the afferent vagal fibres can play. Probably the receptors in the lung from which these stimuli arise are of two kinds, one for each respiratory phase.

That such stimuli are constantly passing by the vagus from the lung to the medullary centre is clearly shown in the beautiful curves taken by Einthoven with the string-galvanometer ([15]). These record the electrical changes produced in the peripheral end of the cut vagus by distension of the pulmonary alveoli in the act of breathing. By using a very sensitive capillary galvanometer, Alcock and Seeman ([16]) had previously been able to detect a current of action in the vagus, both during inspiration and expiration.

The great importance of this vagal regulation of the depth of breathing becomes manifest when we think of a case of asthma, for there expiration, hardly a muscular act under normal circumstances, becomes a violent effort, even more so than inspiration. The vagus is acting powerfully, and although it is regulating the depth of the respiration by its afferent impulses, it is acting abnormally as regards its efferent fibres. This we shall see presently.

While there cannot be any doubt that vagal stimuli are continuously passing from the lungs to the respiratory centre, certain recent experiments made by Schafer ([17]) indicate that under ordinary conditions these stimuli are not absolutely necessary, and that the rhythm of breathing, at least in certain animals, can go on regularly and apparently normally in their absence. Section of both vagi in the cat, if it alters the rhythm of breathing, does so only slightly and very temporarily; and it appears from these experiments that the animals may survive the operation for long, provided precautions are taken to prevent asphyxia from paralysis of the laryngeal muscles.

If we are to assume that this finding of Schafer's applies in the case of the human subject, as it very probably does, we must further assume that under ordinary conditions and with

quiet respiration, vagal stimuli are not absolutely necessary or at least are of minor importance. Other stimuli may take their place, most probably stimuli of the nature of muscular sense, proprioceptive stimuli from the tendons and from the muscles which contract and relax during respiration. Under abnormal conditions however, in all forms of dyspnœa, these vagal stimuli must be of high importance, inflation and deflation of the alveoli producing inhibitory and excitory effects on the respiratory centre.

The protective influence which the vagus exercises over the lungs is shown in other ways, for it is by means of the afferent fibres of that nerve that the reflex act of coughing is initiated. We all know how dangerous a situation arises when the nervous mechanism involved in this reflex is disturbed, where, for example, the vagal nuclei have become affected, as in some cases of bulbar paralysis.

The efferent fibres of the vagus innervating the smooth muscle of the bronchi are pre-ganglionic. The post-ganglionic fibres with which they come into synaptic relation are those of local plexuses, homologues of the plexus of Auerbach, and belonging to the para-sympathetic system. These intrinsic bronchial ganglia were first described by Retzius ([18]), later by Oppeln ([19]), and still more recently by Larsell ([20]). It is then through these pre- and post-ganglionic fibres that the vagal stimuli reach the smooth musculature of the bronchi.

That these muscular fibres contract under vagal influence has long been known. The action was first demonstrated by Longet in 1842, though Williams two years previously had found that electrical stimulation of the lung itself produced that effect. Since then numerous confirmatory observations have been made on similar lines.

Many years ago it seemed desirable to the late C. S. Roy and myself ([21]) to test the reaction more exactly. We used a new method whereby we were able to obtain direct tracings of the movements of contraction and dilatation of the bronchi. Curves, of which the annexed figure is an example, were taken by means of a very small balloon of inelastic animal membrane. This balloon was attached to the end of a fine tube which was passed down the trachea into a small bronchus near the middle of the lower lobe of the lung. The tracings were taken by means of an oncometer. Without going into detail it may be said that we found marked bronchial contraction to follow vagal

stimulation. Careful calculation showed us that the bronchus we were using was frequently reduced to one-half or even to one-third of its previous diameter when the vagus was stimulated.

But while this result was merely confirmatory of numerous previous observations obtained by different methods, we were able to record certain other facts of special interest. As might be expected, we found that pilocarpine caused marked bronchial contraction, while atropine blocked all vagal stimuli.

FIG. 2.—Bronchial Contraction on stimulation of peripheral end of Vagus.

Strong bronchial contraction followed asphyxia, but this did not occur if the vagi had been previously cut. I do not know whether this action of bronchial constriction so produced is fully recognised in connection with clinical work. For example, in a case of bronchitis, if the air-passages are so obstructed as to produce dyspnœa, that very dyspnœa by causing bronchial contraction will increase the obstruction and thus present a further obstacle to the entrance of air. Probably the same mechanism is at work to some extent in cases of breathlessness from advanced mitral disease.

But by far the most interesting result which Roy and I noticed in the course of these experiments, was the reversal of

vagal action which occurred under the influence of ether and chloroform. When anæsthesia was thus produced, stimulation of the vagus, instead of causing contraction of the bronchial musculature, was followed by relaxation and consequent dilatation of the bronchi. This singular reversal effect which occurred during the inhalation of ether and of chloroform has an important bearing, as we shall see presently, on the treatment of asthma.

In this connection the reader will recall the observations of Sherrington ([22]), who was the first to show that strychnine and also the toxine of tetanus reversed spinal reflexes, changing as it were the sign of *plus* into that of *minus*. Under their influence stimuli which normally produced muscular contraction now caused inhibition. A year or two later Bayliss ([23]) showed that chloroform reverses vaso-motor stimuli, and more recently Seemann's observations ([24]) prove that under the influence of strychnine the expiratory effect of ammonia when applied to the nostrils is changed to inspiratory.

There is one other point which may be mentioned before leaving the subject of these experiments. Roy and I found evidence indicating that normally the smooth muscle of the bronchi is in a state of tonus.* On cutting the vagus, for example, there was a momentary contraction of the bronchus, due, we believed, to the stimulus produced by section. This was at once followed by dilatation, the diameter of the bronchus increasing beyond its original dimensions. That any such tonus exists has been denied by others, but the recent observations of Gunn ([26]) go to confirm our findings.

Turning now to the clinical side of the question, let us consider how this spasmodic closure of the bronchi may be brought about, by what reflex the efferent fibres of the vagus —pre- or post-ganglionic—may be stimulated. In the main, though not exclusively, the receptors from which the reflex takes origin lie in the mucous membrane of the respiratory tract. From these the stimulus passes up the afferent vagal fibres and is reflected down the efferent.

Lesions in the nostrils form the starting-point of this reflex at times, and, as is well known, persons suffering from

* The term "tonus" is used here to denote what Sherrington ([25]) calls "reflex postural contraction"—a mild contraction, low in tension, proprioceptive in origin, involving minimal muscular fatigue, easily inhibited and easily excited to active contraction.

repeated attacks of bronchitis, especially if the condition becomes chronic, often develop asthma. Probably here we are dealing with the results of summation of stimuli and of facilitation. The inhalation of dust may act as a temporary stimulus causing the bronchi to contract. Indeed, this is one of the ways in which the lungs are automatically protected from injury.

Similarly, irritant gases cause strong reflex action in this arc, producing among other effects marked bronchial spasm. Experimentally, Symes and Golla ([27]) have shown that this occurs when the vapour of bromine is inhaled, and Gunn ([25]) finds a corresponding effect to follow chlorine. The best way to combat the spasm so produced is to paralyse the vagal endings in the bronchial musculature by means of atropine, as the experiments of Cow ([28]) indicate. But it must be remembered that if the agent at work causes much bronchial secretion or much swelling of the mucous membrane, the mere paralysis of the muscular coat may produce but little effect in diminishing the obstruction to the entrance and exit of air.

Other reflexes capable of producing bronchial constriction may arise in an over-filled stomach or an over-loaded colon or rectum. Uterine stimuli, especially during menstruation, may produce a like effect, as may also the application of cold to the skin. Chilling the feet, for example, is sometimes followed immediately by bronchial constriction, as Hyde Salter ([29]) observed. An outburst of laughter if prolonged may, as I have myself experienced, pass into an attack of marked bronchial constriction. Various psychical conditions may act similarly, especially those of depression, such as occur from worries in business.

There is evidence, as we have seen, that the bronchial musculature is normally in a state of tonus. Indeed, even apart from experimental evidence, this is what we should expect, for these smooth fibres possess a double innervation, and, being in a certain degree of tonus, they are in a position to contract or to relax according as the stimuli reaching them are excitory or inhibitory. Thus we see here the same balance of the two antagonistic autonomic systems so frequently encountered elsewhere, for the inhibitory fibres innervating the bronchial muscles are sympathetic in their origin. Their cells lie in the intermedio-lateral tract, and according to Dixon and Ransom ([30]), in the first, second, and third dorsal segments of the cord. Stimulation of these fibres produces a powerful

inhibitory effect on the bronchial musculature, with consequent dilatation of the bronchi. Adrenaline has the same effect, as we all know from clinical experience, and Cannon ([31]) points out that the out-pouring of adrenaline produced by emotional excitement, in causing such dilatation, renders the organism more efficient to meet danger. Thus, when the para-sympathetic dominates, the tone of these smooth muscle fibres increases and the calibre of the bronchi narrows, whereas in conditions of hyper-excitation of the sympathetic there is inhibition with consequent bronchial dilatation.

To return to the para-sympathetic innervation of these smooth muscle-fibres, it is to be remembered that in some persons, from inborn hereditary causes, there is hypertonus of the vagus. In them the phenomena resulting therefrom, chiefly in the form of asthma, will be most likely to manifest themselves during the night, for, as has been previously observed, night is the time of the smooth muscle so innervated. The hereditary factor in regard to asthma has been carefully worked out by Freeman ([32]), and, from the point of view of the accompanying eosinophilia, by Klinkert ([33]). Repeated attacks of asthma tend to cause hypertrophy of the bronchial musculature, as has been shown by Huber and Koessler ([34]), and this is what we should expect.

We are dealing then with cases in which there is a hyper-sensitive vagal system, whatever may be its cause, inherited or acquired. The degree of sensitiveness, however, varies much in different persons, sometimes being small, sometimes great, and the occurrence of attacks of bronchial spasm will vary accordingly in frequency and in severity. But obviously the tonus of which we are thinking must depend largely on that of the sympathetic neurones. Whatever depresses the latter, such as mental worry, will tend to increase relatively the vagal tonus and may thus produce bronchial spasm in those otherwise predisposed. On the other hand, such emotions as stimulate the sympathetic have an opposite effect, and in the presence of sudden and imminent danger an asthmatic attack has been known to cease abruptly. A condition of hypertonus of the sympathetic occurs much more frequently in women than in men, and this probably accounts for the fact that asthma is met with more often in male patients than in female. Hyde Salter ([29]) from his large experience estimated the proportion as being that of 2 : 1.

J. J. Graham Brown

While a certain number of cases are on record in which an attack of asthma was cut short by the emotion of fear, I met with one some years ago which on a superficial view of the facts might easily have led to an opposite opinion. At the age of fifty-two, Charles W., who was suffering from severe asthmatic seizures, gave me the following account of his medical history. Some years before I saw him he had been one of many to suffer in a railway accident—not that he was physically injured to any considerable extent, but that he experienced the results of severe shock which prostrated him. His symptoms at that time must have resembled closely those which many of us have seen in genuine cases of marked "shell-shock," for in the months which followed the accident he was, he told me, constantly in a state of fear, and this mental disturbance showed itself at night in the shape of correspondingly terrifying dreams. This fear-neurosis, after dominating his mind for many months, gradually abated, and when I saw him it had in great measure disappeared, though even then he was in a distinctly nervous condition. About a year and a half before he came to see me, he had had three curious attacks in which the globus hystericus was prominent as a symptom, undoubtedly manifestations of functional disorder of that nature. These did not recur. His first attack of asthma came on suddenly one night without obvious cause. He was then, as I have said, fifty-two years of age. Three months later, I saw him and was able to satisfy myself that the dyspnœa which occurred each night and was sometimes very severe, was a true bronchial asthma. The physical signs and symptoms were typical. The sputum, thick and tenacious, contained Curschmann's spirals and Charcot-Leyden crystals.

As regards his general appearance, he was a thin man with a dark, sallow complexion. His skin was thick and greasy, his hands cold and damp with perspiration. He came of a neurotic family, was himself distinctly neurotic, and his expression was that of anxiety and depression.

Here then was a man who had passed through moments of great fear—a fear which had developed into an anxiety neurosis lasting more or less severely for years, and not even completely recovered from. In the course of this he had developed a passing hysterical condition, and then finally and suddenly, severe asthma had seized him.

Undoubtedly, or so it seemed to me, the shock of the

railway accident was the starting-point of this sequence of symptoms—a shock producing great fear not easily recovered from by a man of his neurotic constitution. Had he been in the midst of an attack of asthma at the time, that great fear with its attendant hyperadrenalism would probably have cut the attack short at once, the para-sympathetic stimuli being overpowered by the sympathetic. Why then did he develop asthma years afterwards?

My reading of the phenomena of this case was that in the months and years during which he was in a state of more or less constant fear, his supra-renal glands, over-stimulated for so long, had become gradually exhausted, with a consequent fall in the tonus of the sympathetic, and a corresponding relative rise in that of the para-sympathetic.

I found some support for this view when I noticed that his pulse rate was rather slow, and that his temperature, usually about 96°, seldom passed 97°. There was in addition a fact which weighed with me still more. As a rule in cases of asthma a quite small dose of adrenaline suffices to stop the attack. In this man's case, however, very large doses were required—10 or even 15 minims of 1 : 1000 solution were needed before the bronchial spasm was relieved.

Leaving now for the moment the consideration of the results of hyper-adrenalism, and apart from the question of hereditary hypertonus of the vagus already discussed and from such reflex effects as have been mentioned, let us ask ourselves the question: Where are we to look for the cause of the intense bronchial constriction which occurs in the asthmatic seizure? It is now generally held that bronchial spasm is a part of the anaphylactic syndrome. In experimental work that symptom is very marked in the guinea-pig, usually leading to the death of the animal. It is seen also in man, though fortunately fatal anaphylaxis is not frequent in the human subject, being almost entirely limited to cases of chronic asthma in which anti-diphtheritic serum has had to be given. Occasionally, however, anaphylactic shock is seen in connection with vaccine treatment and with the administration of anti-tetanus serum.

The discovery of the anaphylactic reaction was first made in 1902 by Portier and Richet ([35]). Since that date the whole subject has become so wide in its scope and the literature dealing with it so enormous that no attempt can be made here

to cover the ground. The reader may be referred to the works of Richet ([36]) and of Besredka ([37]) and to the very excellent survey of more recent investigations given by Gideon Wells ([38]). There are, however, a few points to which reference may be made here since they touch more directly on the present subject.

What is the relation of anaphylaxis to asthma? It may safely be said that the majority, probably the large majority, of asthmatic cases result from anaphylaxis. When the disease begins in childhood or in adolescence certainly 90 per cent. of such cases originate in that way, and probably all so arise. On the other hand, when attacks of bronchial constriction commence after the age of forty, no such clear connection can usually be established. Most of these arise from reflex causes such as have been mentioned above.

In its nature, the anaphylactic shock is an antigen-antibody reaction. The antigen must be a soluble protein and must be foreign to the organism, though not all proteins are capable of producing the phenomenon. The remarkable specificity of the process has been clearly established by Dale ([39]), working with the virgin uterus of the guinea-pig.

The animal or the human being is first sensitized by a minute quantity of the antigen. This sensitization is not complete for some ten or twelve days. Thereafter the administration of a larger dose causes the anaphylactic shock.

If we confine our attention to man in relation to asthma, we must realise that the antigens which are capable of producing that disease are very numerous. Probably some hundreds of different proteins may act as sensitizing agents in those predisposed. The multitude of proteins contained in grain of various kinds, in white of egg, and in all sorts and varieties of food, as well as those formed by bacterial action in cases of intestinal toxæmia may, each and all, act as possible antigens. In addition to these, there are certain proteins which are absorbed by the mucous membrane of the respiratory tract. To this class belong the various pollens of grasses and other plants as well as proteins attached to animal and even to human hair. But, so far as dangerous anaphylaxis in man is concerned, the protein which we most dread is contained in horse-serum, and, as has already been said, the administration of diphtheria antitoxine to persons who give a history of asthma may be followed by serious, sometimes by fatal, shock.

For example, Gillette [40] records 28 cases in which severe anaphylactic shock followed injection of that antitoxine. Of these, 21 gave a history of asthma, 15 proving fatal. E. W. Goodall [41] confirms this.

Fortunately, in those suffering from asthma due to anaphylaxis, it is sometimes possible to discover the exact antigen which is at work. This is done by the well-known method of skin-reaction—the reaction being indicated by the urticarial wheal which develops when the protein at work in the particular case is rubbed into a light scratch on the arm. Many proteins may have to be tried before a definite result is obtained.

But, although we are all exposed at one time or another to the attack of such antigens, yet comparatively few, perhaps 10 per cent., suffer from even the mildest forms of distinct anaphylactic action. There must therefore be predisposition, a hypersensitiveness of some kind present in those who so suffer. Many clinicians have noted that this hypersensitiveness runs in certain families, and the statistics of Freeman [31] bring the point out clearly. It is noteworthy that in a family where this hypersensitiveness prevails, one brother or sister may react to the hair of the horse, another to that of the cat, and a third to some protein contained in food. It can hardly therefore be specific sensitization which is transmitted from parent to child. Other grounds on which this opinion rests are fully stated by Cooke and Vander Veer [42].

We have now to consider a very difficult question, namely: In or on what cells does the anaphylactic reaction take place? Let us limit ourselves to the subject with which we are presently concerned, that of bronchial constriction from antigen-antibody reaction. In doing so it will be best to take the results of experiments on the guinea-pig, for death in that animal is mainly due to intense bronchial spasm and consequent asphyxia.

In the first place it is evident that all central causes must be eliminated from our consideration, for section of both vagi does not affect the spasm [43], and smooth muscle separated from all intrinsic ganglia gives the reaction. It must therefore be local, the reaction taking place either in the smooth muscle fibres themselves or in the myo-neural junction tissue of post-ganglionic vagal fibres. I am inclined myself to take the latter view for various reasons. There is no doubt that atropine which paralyses this junction-tissue is capable of

preventing the fatal result of the shock dose. Karsner [44] indeed gives figures showing the particular dose of atropine required to cause this effect, with varying doses of antigen. Auer [45] observed the same result in his experiments. Moreover, one of the criteria [38] which must be fulfilled before any action can be pronounced to be truly anaphylactic is that it is capable of modification or abolition by means of atropine. Thus, as atropine, which is known to paralyse the vagal endings, antagonises the anaphylactic reaction, it seems reasonable to assume that that reaction occurs on or in the neuro-muscular junction tissue. I cannot feel that Dale's beautiful experiments [39] on the washed uterus in any way invalidate this conclusion, for obviously, although all nerves were removed from the preparation, the junction tissue must still have remained.

Another argument pointing in some degree though not conclusively in the same direction is found in the action of adrenaline, for by it anaphylactic shock can be weakened or entirely prevented. This, indeed, is another of the criteria which must be met before true anaphylaxis can be assumed to have occurred. And as adrenaline acts on myo-neural junctions, inhibiting contraction of the smooth muscle this tends to support the argument I have given.

The action of histamine [46] resembles anaphylactic shock in some measure and it probably acts on the same tissue, but for various reasons, certain of which are given by Gideon Wells [38], it is evident that the two actions are not identical.

In cases of anaphylactic asthma in which by skin tests the antigen at work can be exactly and definitely determined, a process of desensitization should be attempted, minute but gradually increasing doses of the protein in question being given. Where no such determination has been found possible, vaccines prepared from the bronchial secretion or from the intestinal flora may usefully be tried.

In animal experiments it has been found by Besredka [47] that alcohol given by the mouth or by the rectum is capable of stopping the anaphylactic action. It has long been known that an asthmatic attack in man may be arrested in the same way, but unfortunately this result cannot be attained until a certain amount of intoxication is induced. The danger of its use is therefore obvious, for not only must the dose of whisky be large, but it must be increased from day to day and this with necessarily deplorable results.

Ether, in animals, has been found by many observers to stop anaphylaxis, and, according to Besredka ([48]), anæsthesia so produced leads to more or less permanent immunity. A similar result is said to follow the administration of chloral.

Before leaving this part of the subject, something may be said regarding the treatment of severe anaphylactic shock in the human subject, though fortunately this is a comparatively rare occurrence. In such circumstances, ether or chloroform should be administered instantly and a full dose of adrenaline injected under the skin. If there is time, alcohol may be given by the rectum. A practitioner who has cause to fear the possibility of anaphylaxis in a given case should take care to have his syringe already charged with adrenaline close at hand, and an anæsthetic within reach, for shock symptoms may come on with alarming rapidity.

Turning now to consider a severe attack of asthma in the human subject arising from whatever cause, let us ask ourselves how far the facts mentioned above form a guide to the lines of treatment which should be adopted and to what extent they can explain their mode of action.

The bronchial spasm which is producing the main signs and symptoms of asthma may be arrested in various ways:—

1. We may produce the reversal effect, changing the stimulus from one of contraction of the smooth bronchial muscle to one of inhibition with consequent dilatation. It has been shown above (see page 61) that the inhalation of chloroform or of ether causes this reversal, the bronchi then dilating under vagal stimulation instead of contracting. Undoubtedly in the human subject, inhalation of either of these anæsthetics will stop the paroxysm. The dangers of such treatment are obvious. Some years ago I was asked to see a lady severely asthmatic, who was passing through Edinburgh on her way to her home in the south. On a table at her bedside stood a bottle of chloroform with a handkerchief, already prepared, lying by it. She told me that every night she went to sleep with this handkerchief, well soaked, laid over mouth and nose. My warnings were quite in vain. Although her husband was in a very good position and her father a man of high distinction, the woman was untidy to a degree, as such drug-takers usually are, and distinctly unclean. She returned home and died shortly afterwards. I am given to understand there were no grievous lamentations. Chloroform had wrecked what might and ought to have been a noble life.

Alcohol probably acts in much the same way, and its habitual use in the quantities required leads to grave danger, as I have already said.

2. The vagal endings in the smooth muscle may be paralysed so that the spasm ceases, and the bronchi dilate. This action may be produced by means of atropine administered by the mouth or hypodermically, and the fumes of smouldering stramonium, which relieve in many cases, act in this way. I have occasionally used papaverine for the same purpose. Its action resembles that of atropine. The nitrites inhaled from burning nitre-paper cause relaxation of the bronchi, but their point of action is not certainly ascertained. Many of the powders sold for a like purpose should be avoided, partly because their repeated use tends to cause bronchitis, and so aggravates the condition, and partly, as Broadbent showed years ago, because they may induce cardiac dilatation. If bronchitis is present in cases of asthma, a course of autogenous vaccine should be given.

3. By far the best way of stopping an asthmatic attack is to inhibit the smooth muscle, and so to cause relaxation. This can be done by means of adrenaline, and fortunately a quite small dose of two or three minims of a 1 : 1000 solution is usually sufficient. Any unpleasant effects which a full dose might occasion are thereby avoided. In using this form of treatment, we are raising the sympathetic tone so as to overbalance that of the para-sympathetic which is causing the bronchial spasm. The hyper-adrenalism to which strong emotion gives rise is probably the cause of the sudden suppression of asthma under such conditions. Many instances of this result are on record. I have already referred to the subject on page 68.

The good effect of the prolonged administration of iodide of potassium is probably to be explained in the same way, the iodine stimulating the thyroid and that in turn increasing the supra-renal secretion. Courses of thyroid extract may be given with the same object in view, but, during the administration of this hormone the patient should be kept under careful observation. The rate of the pulse and the blood-pressure should be regularly recorded, any marked rise in either being taken as an indication for reducing the dose of the preparation used. These precautions are particularly necessary when the hormone is being given in considerable doses over long periods

of time, for there is then a risk of producing myocardial degeneration such as is sometimes found in cases of Graves' disease. In experimental work ([49]) lesions of this kind have been produced by thyroid feeding.

It might be supposed that a similar danger is to be dreaded when adrenaline is being administered over long periods. This does not however appear to be the case, probably because of the evanescence of the action produced by that hormone. To the patient whose case is mentioned on page 64 adrenaline was given in large doses once and sometimes twice a day for many weeks without any obvious ill effect.

In another case of the same kind (E. M'F.) the first attack of asthma occurred at the age of forty-three. Here also there was evidence of neurotic inheritance. The paroxysms were at first quite typical of pure asthma. Eosinophilia in the intervals between the hours of attack reached 4·5 per cent., rising during the attack to 8 per cent. In this case the bronchial constriction was more easily inhibited than in the patient previously mentioned. The hypodermic dose of adrenaline required was small, five minims sufficing to give relief. This treatment though of long duration did not produce any evident deleterious effect on the circulation.

For the sake of brevity I have not alluded to the general measures which it is advisable to take—the regulation of life, questions of climate, of food, etc. One further point, however, deserves passing mention. The practitioner should not use quinine as a tonic in such cases, for there is some reason to believe that quinine increases the susceptibility of the organism to foreign protein ([50]).

References.

[1] Molhant, "Le noyau ventral du Vague, et le noyau ambigu," *Le Névraxe*, Vol. 12 (1911), p. 221.

[2] Edinger, *Vorl. ueber den Bau der nervösen Zentralorgane*, Leipzig, 1911.

[3] Molhant, "Le noyau dorsal du Vague," *Le Névraxe*, Vol. 11 (1910), p. 131.

[4] Gaskell, *The Involuntary Nervous System*, London, 1916.

[5] First described by Staderini in a Journal to which I have not been able to obtain access: *Monitore Zool. Ital.*, Anno v. (1894). In the following year he again described it, "Sur un noyau de cellules nerveuses intercalé entre les noyaux d'origine du Vague et de l'Hypoglosse," *Arch. Ital. de Biol.*, Vol. 23 (1895), p. 41. More recently, in 1906, in the *Anat. Anzeiger*, Bd. 29, he gives further details.

[6] Streeter, "Anatomy of the Floor of the Fourth Ventricle," *Amer. Journ. of Anatomy*, Vol. 2 (1902-3), p. 299.
[7] Jacobsohn, "Ueber die Kerne des menschlichen Hirnstamms," *Anh. Abh. d. k. preuss. Akad. der Wiss.*, 1909, S. 1.
[8] Müller, "Beiträge zur Anatomie, Histologie, und Physiologie des Nervus Vagus," *D. Arch. f. klin. Med.*, Bd. 101 (1911), S. 421.
[9] Nordkemper, "Zur Frage der Umschaltung der parasympatischen Vagusanteile im Ggl. Nodosum und Ggl. Jugulare," *Anatomische Anzeiger*, Bd. 53 (1921), S. 501.
[10] Graham Brown, J. J., "Ataxia : A Symptom," *Edin. Med. Journ.*, 1912.
[11] Ranson, *The Anatomy of the Nervous System*, Philadelphia and London, 1920.
[12] Haldane, J. S., "Some Recent Advances in the Physiology of Respiration, Renal Secretion, and Circulation," *Brit. Med. Journ.*, 19th March 1921.
[13] Hering and Breuer, "Die Selbststeuerung der Athmung durch den Nervus Vagus," *Sitzb. wiener Akad.*, 1868.
[14] Head, H., "The Regulation of Respiration," *Journ. of Physiol.*, Vol. 10 (1889), pp. 1 and 279.
[15] Einthoven, W., "On Vagus Currents examined with the String-galvanometer," *Q. Journ. of Exp. Med.*, Vol. 1 (1908), p. 243. More fully in *Pfl. Arch.*, Bd. 124 (1908), S. 246.
[16] Alcock and Seemann, "On the Negative Variation in the Pulmonary Fibres of the Vagus," *Proc. Physiol. Soc., Journ. of Physiol.*, Vol. 32 (1905), p. xxx.
[17] Schafer, E. S., "Experiments on the Cervical Vagus and Sympathetic," *Q. Journ. of Exp. Physiol.*, Vol. 12 (1919), p. 231.
[18] Retzius, G., "Zur Kenntniss der Nervenendigungen in den Lungen," *Biolog. Untersuchungen*, Bd. 5 (1893), S. 41.
[19] Oppel, *Lehrbuch der vergleich. mikros. Anat. der Wirbeltiere*, Teil 6 (1905), SS. 605 und 680.
[20] Larsell, O., "Nerve Terminations in the Lung of the Rabbit," *Journ. of Comp. Neurol.*, Vol. 33 (1921), p. 105.
[21] Roy, C. S., and Graham Brown, J. J., "On Bronchial Contraction," *Journ. of Physiol.*, Vol. 6 (1885), p. xxi.
[22] Sherrington, C. S., "On Reciprocal Innervation of Antagonistic Muscles," *Proc. Roy. Soc. of London*, Vol. 76B (1905), p. 269.
[23] Bayliss, W. M., "On Reciprocal Innervation in Vaso-motor Reflexes and the Action of Strychnine and of Chloroform thereon," *Proc. Roy. Soc. of London*, Vol. 80B (1908), p. 339.
[24] Seemann, J., "Ueber die durch Strychnin hervorgerufene Reflex-umkehr bei Atemreflexen," *Zeit. f. Biol.*, Bd. 54, S. 153.
[25] Sherrington, C. S., "Postural Activity of Muscle and Nerve," *Brain*, Vol. 38 (1915), p. 191.
[26] Gunn, "Action of Chlorine on Bronchi," *Q. Journ. of Med.*, Vol. 12 (1920), p. 121.
[27] Symes and Golla, "Note on the Bronchiolar Obstruction set up by Irritant Vapour and its Relief by Atropine," *Journ. of Physiol.*, Vol. 49, (1915), p. lv.
[8] Cow, D. V., "The Use of Atropine in the Treatment of those Suffering from the Effects of Irritant and other Gases," *Lancet*, 29th May 1915, p. 1147.

[29] Hyde Salter, H., "*On Asthma: Its Pathology and Treatment*," 2nd Ed. London, 1868.
[30] Dixon and Ransom, "Broncho-dilator Nerves," *Journ. of Physiol.*, Vol. 45 (1912), p. 413.
[31] Cannon, W. B., *Bodily Changes in Pain, Hunger, Fear, and Rage*, New York and London, 1915.
[32] Freeman, J., "Toxic Idiopathies," *Proc. Roy. Soc. of Med.*, Vol. 13 (1920), p. 129.
[33] Klinkert, "Das Problem der konstitutionellen Eosinophilie," *Z. f. kl. Med.*, Bd. 89 (1920), S. 156.
[34] Huber and Koessler, "Pathological Histology of the Lung Structure in Bronchial Asthma," *Trans. Chicago Pathol. Soc.*, Vol. 11 (1920), p. 128.
[35] Portier and Richet, "De l'action anaphylactique de certains venins," *Bull. Soc. Biol.*, 1902, p. 176.
[36] Richet, C., *L'anaphylaxie*, 3me Ed., Paris, 1914.
[37] Besredka, A., "Anaphylaxis and Anti-anaphylaxis," English Edition, 1919. This edition contains a chapter which does not appear in the French original.
[38] Wells, Gideon, "The Present Status of the Problems of Anaphylaxis," *Physiological Reviews*, Vol. 1 (1921), p. 44.
[39] Dale, H. H., "The Biological Significance of Anaphylaxis," *Proc. Roy. Soc. of London*, Vol. 91B (1920), p. 126.
[40] Gillette, "Untoward Results from Diphtheria Anti-toxin, with Special Reference to its Relation to Asthma," *Therapeutic Gaz.*, Vol. 33 (1909), p. 159.
[41] Goodall, E. W., "On Some Points connected with the Serum Treatment of Diphtheria," *Brit. Med. Journ.*, 11th February 1911, p. 292.
[42] Cook and Vander Veer, "Human Sensitization," *Journ. of Immun.*, Vol. 1 (1916), p. 201.
[43] Schuerer and Strasmann, "Zur Physiologie des anaphylaktischen Shocks," *Zeit. f. Immun.*, Bd. 12 (1912), S. 143.
[44] Karsner, "The Relation of the Intoxicating Dose of Horse-serum to the Protective Dose of Atropine in the Guinea-pig," *J. Amer. Med. Assoc.*, Vol. 57 (1911), p. 1023.
[45] Auer, "Anaphylaxie und Atropine," *Zeit. f. Immun.*, Bd. 12 (1912), S. 235.
[46] Dale and Richards, "The Vaso-dilator Action of Histamine and some other Substances," *Journ. of Physiol.*, Vol. 52 (1918), p. 110.
[47] Besredka, A., "Des moyens d'empêcher les troubles anaphylactiques," *C. R. Soc. de Biol.*, tome 66 (1909), p. 125.
[48] Besredka, A., "Comment peut-on combattre l'anaphylaxie?" *Ann. Inst., Past.*, Vol. 21 (1907), p. 950.
[49] Goodpasture, E. W., "The Influence of Thyroid Products on the Production of Myocardial Necrosis," *Journ. of Exp. Med.*, Vol. 34 (1921), p. 407.
[50] Smith, M. J. "Studies in Anaphylaxis," *Journ. of Immun.*, Vol. 5 (1920), p. 239.

CRITICAL REVIEW

CÆSAREAN SECTION: ITS INDICATIONS AND TECHNIQUE.

By J. W. BALLANTYNE, M.D., F.R.C.P.E., Lecturer on Midwifery and Gynecology (to Women Students) in the University of Edinburgh.

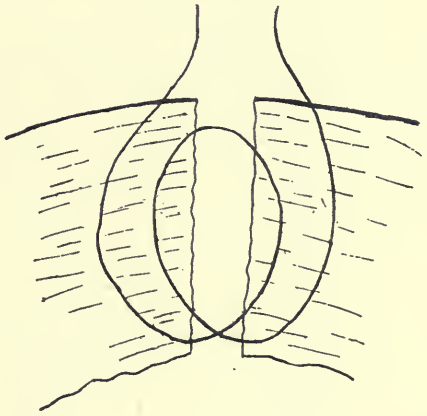
(*Continued from page* 40.)

Technique of the Cæsarean Section.

A FEW modifications of the technique of the classical conservative Cæsarean section have been suggested during recent years, mostly with the purpose of lessening the risks in infected or presumably infected cases, or of increasing the stability of the uterine scar. In order to ensure the reliability of the scar in future pregnancies, Arnold Jones [55] proposes to make the uterine incision in a new way. Making use of the fact that the musculature of the pregnant uterus is arranged in layers, he incises first the external layer of transverse fibres by means of a transverse incision "just below the centre of the body in front and 2 inches above Bandl's ring," after having first separated this layer from the underlying one by blunt scissors; then with gauze he peels off this superficial layer from the middle layer below and pushes it up towards the fundus; next, after ligaturing any bleeding points, he incises the middle and internal muscular layers longitudinally in or near the middle line. The extraction of the child is then performed as usual, and the longitudinal incision is closed by a continuous No. 4 catgut suture, the outer layer is pulled down into position, and the transverse incision is closed in the same way. Jones has used this method eight times and thinks it will give a firmer scar. His suggestion is worthy of consideration, but at first sight its adoption would apparently mean the spending of more time over the uterine incision than is usually given to it; it may, however, have counterbalancing advantages.

A good deal of discussion has taken place as to the best material which sutures should consist of in order to ensure a strong uterine cicatrix. There has been difference of opinion both as regards material and the method of passing the sutures. For instance, Skeel [97] closes the uterus with a continuous suture of No. 2 chromic gut for the deep layer and plain catgut for the peritoneum, whilst Beck,[7] using the same material, passes the sutures interruptedly. R. C. Cochrane [18a] also uses chromic catgut (No. 1) interruptedly for the deep layer and continuous for the peritoneum. Ley [63] employed Pagenstecker thread sutures, but a pyosalpinx developed later.

Lapthorn Smith[99] chooses catgut for the wall and fine silk for the peritoneum. Vanverts and Paucot[106] used either silk or catgut, but they preferred catgut; in order to increase the solidity of the scar they passed the sutures in a double circle (see Fig.). Holland,[46, 47] who has made a special study of the suture material, decides in favour of silk-worm gut as the best, with silk as the second best, and he condemns catgut. The reviewer has always made use of silk passed interruptedly for the deep suturing of the uterine wall, and catgut passed continuously for the bringing together of the peritoneum; in one instance, in which he did a second Cæsarean some eighteen months later, he could discover no trace of the silk.



With regard, however, to absorption, opinions and facts also seem to differ, for Maclean[70] in four months found the sutures present, and Clifford White[108] discovered silk and thread unabsorbed and giving rise to trouble.

In order to keep the uterine incision free from infection, some modifications in technique have recently been suggested. One of these, referred to by Jefferson of Rochdale,[54] is very simple and may well be adopted without question; it consists in putting on a fresh pair of sterilised gloves immediately after the placenta and membranes have been extracted from the uterus, and before the stitching up of the incision is commenced. The reason for the change is that the interior of the membranes may have become infected by way of the cervix, and so the hands which touch the interior of the sac of the membranes may become infected. Jefferson further recommends the swabbing of the interior of the uterus and of the edges of the incision twice with iodine and the changing of the sterilised towels round the operation area. For the same purpose some operators (*e.g.* Delle Chiaje[18]) always remove the uterus

from the abdomen before opening it, but all are not of one mind about this "exteriorisation" of the uterus, and certainly it requires a much longer abdominal incision. In septic cases requiring Cæsarean section, Dr Charles L. Ill[49] strongly recommends the use of the alcohol drain, which is the adoption in the technique of the section of the so-called Carossa method employed by his brother, Dr Edward J. Ill, in puerperal endometritis. The plan consists in introducing into the uterus through the vagina (the abdomen having been closed and dressed) 4 inches of a rubber tube about 2 feet in length and with a funnel-shaped attachment. Around the tube a strip of iodoform gauze (10 per cent.) 2 inches in width is lightly packed, and the vagina is packed with the same material. Two ounces of a 25 per cent. solution of alcohol in water are allowed to flow slowly through the tube and moisten the gauze in the uterus and vagina. This is done every two hours, day and night for four days. In the discussion which followed the reading of Dr Ill's paper, Dr Edward A. Weiss suggested the employment of the Dakin tube to carry out the drainage. Of course, it is under exceptional circumstances that the conservative Cæsarean section will be performed in so distinctly infected cases as Dr Ill presupposes; generally the operator will do a hysterectomy.

The acknowledged difficulty of dealing safely with a "handled" and presumably infected case is the fertile cause of many suggested alterations in technique, for it is everywhere admitted that the present rate of maternal mortality even in the hands of expert obstetricians is too high to justify the ordinary conservative high operation. Some have sought for a way out of the difficulty by making the incision low down in the uterus, the cervical or lower-segment operation. A number of advantages (which are enumerated by Eardley Holland,[46, 47]) are claimed for the low incision: the wound is in an inactive area of the uterus and heals more quickly; the wall is thinner and suturing is more efficient; it is a less vascular area and bleeding during the operation is less; adhesions cannot occur for the wound is covered by the bladder; for this reason also infection of the peritoneum is less likely; there is less disturbance in the general abdominal cavity; and the uterine scar forms in a safer area of the uterus so far as future pregnancy and the risk of rupture are concerned. On the other hand the operation has a more difficult technique; there is sometimes difficulty in the extraction of the child, and there is a risk of hæmorrhage (according to some operators). Skeel[97] thinks that an additional advantage attaching to the low incision is that the pelvic peritoneum has greater resistance to infection than the abdominal.

The cervical Cæsarean has considerable vogue in Germany, and Lichtenstein[65] has recorded 143 such operations. In 106 of these

cases he performed the intraperitoneal operation, and in the others a form of the extraperitoneal or of the transperitoneal method was employed (in 3 cases it was Frank's, in 11 Sellheim's, in 11 Latzko's, and in 12 Latzko-Zweifel's). The true extraperitoneal plan is much less heard of now than formerly; the difficulty of reflecting the peritoneum from the bladder without buttonholing, and the fact that in many cases prevention of peritoneal infection is only achieved at the expense of infection of the cellular tissue, have militated against its general adoption. M'Glinn[71] carefully weighs the advantages and disadvantages of both the true extraperitoneal and the transperitoneal methods, and he is doubtful whether either of them really prevents infection. He thinks advantages are rather outweighed by disadvantages, and he finds much that is satisfactory in the ordinary conservative Cæsarean section as done by Sänger. It ought to be remembered that many operations described as extraperitoneal (*e.g.*, Brodhead's[11] and Langrock's[59]) are little removed in reality from transperitoneal, and that not a few of the transperitoneal are truly intraperitoneal. Whilst the genuine extraperitoneal plan has probably ceased to be of practical importance, many obstetricians (*e.g.*, Gaifami[39]) will not agree with M'Glinn that the transperitoneal methods do not warrant further investigation and trial; indeed, M'Glinn himself finds good points in Beck's operation (a modification of Krönig's). Beck[7] described his procedure in 1919, and he amplified the description in 1921[8]; T. S. Welton[107] has also used the method in eleven instances and thinks it is the operation of choice in all potentially infected cases. It has been termed "the two-flap low incision Cæsarean section," and it is carried out as follows. The abdomen is opened by a vertical incision slightly to one side of the middle line from the symphysis to nearly the level of the umbilicus; but Beck has no objection to a transverse one. The loose peritoneum in the region of the bladder reflection is cut transversely; the peritoneum on the lower side of the incision along with the bladder are stripped off the anterior surface of the uterus as in a sub-total hysterectomy. Then the peritoneum on the upper side of the transverse incision is carefully separated from the underlying uterus by a pair of probe pointed (Mayo) scissors thus producing a superior flap about 1½ inches long. The lower and upper peritoneal flaps are retracted until a sufficient area of the anterior uterine surface is exposed to make an ample incision. At this stage Dr Beck's assistant gives a hypodermic injection of pituitrin; and the uterus is pressed well into the abdominal incision to wall off the peritoneal cavity. Next a stab wound is made in the mid-line of the uterus and this is quickly enlarged by scissors. The operator then passes his hand into the uterine cavity and using it like a lever presses the presenting

part out, his assistant aiding the manœuvre by downward pressure on the fundus. If necessary, forceps may be used to extract the head. Before separating and removing the placenta and membranes deep traction catgut sutures are passed through the uterine wall above and below the upper and lower ends of the uterine incision; these fix the incision, prevent its lower end passing out of reach down into the pelvis, and greatly facilitate the closing of it. The placenta and membranes are then either extracted through the wound or pushed down into the vagina through the cervix. A second hypodermic injection of pituitrin is now given. The wound in the uterine musculature is next closed by two series of interrupted chromic catgut sutures, deep and more superficial. They along with the traction sutures are now tied, and the closed incision drops to some extent into the pelvis. Next, the upper peritoneal flap is brought down over the upper part of the incision and anchored to the uterus by interrupted plain catgut sutures; the lower peritoneal flap with the bladder reflection is then pulled up and made slightly to overlap the upper flap and fixed in position with interrupted superficial plain catgut sutures. In this way the peritoneal cavity is completely sealed off from the closed uterine wound. Beck in 37 cases done by this method lost one mother probably from eclampsia. In a later communication Beck[8] reported on 83 Cæsarean sections done by himself and others in which this technique was used; there were three maternal deaths (3.6 per cent.), and as only 12 of the operations were elective procedures (the remaining 71 being all "potentially infected" cases), the writer is justified in recommending his plan in such handled subjects. To facilitate the rather difficult technique especially in the making of the two peritoneal flaps, the author recommends the Trendelenburg position. There would seem to be a risk, even with this technique, of spilling amniotic fluid into the peritoneal cavity, unless the assistant is indeed expert in walling off the cavity by bringing the uterine surface into the abdominal wound. Suture infection, however, seems to be as surely avoided as one can well imagine.

Whether the great problem of doing Cæsarean section on potentially infected cases with safety to the mother has been solved by one or other of the "low" operations of a transperitoneal kind cannot yet be definitely decided; but it should not be long before one will be in a position to tell. Meanwhile, some operators rely rather on removal of the uterus to save the mother from the septic peritonitis which so often follows the performance of Cæsarean section in a patient who has been "handled" (*e.g.* by many vaginal examinations, attempts at forceps-delivery, etc.). The extreme degree of this form of operative interference is found in Reymond's procedure of

hysterectomy without previous opening of the uterus. In 1914 (*Edin. Med. Journ.*) the reviewer described and commented upon the three cases operated upon by Reymond and Casalis and by Casalis and Lecoq in which *delivery by hysterectomy* was achieved. The indications were placenta prævia, cancer of the cervix, and impending uterine rupture in a handled case of pelvic contraction. In each instance a panhysterectomy was performed and the whole uterus unopened and containing the living child was removed from the body; immediately thereafter the organ was opened by an assistant, and the infant extracted and resuscitated. The three mothers were saved, and by almost unexpected good fortune so were the infants. Obviously the risk to the fœtus must be considerable for the arteries supplying the uterus, and therefore of necessity the placenta must be clamped before the hysterectomy can be done. Reymond got over this risk in part by leaving the right uterine artery unclamped till the second before the uterus was separated and lifted out of the abdomen. Of necessity great skill and very rapid action were called for at this critical moment, qualifications possessed only by the expert hysterectomist. Lecoq[61] now reports five cases in which delivery by hysterectomy was performed; one mother died on the fourth day from general peritonitis, the others lived, as did all the babies. The technique is that of panhysterectomy for a large fibroid: this entails a large abdominal incision (10 inches long) to allow the removal of the unopened uterus, complete knowledge of the technique of a panhysterectomy, expert speed in controlling the blood supply of the uterus and in removing the organ, and the presence of a skilled assistant to cut the child out of the uterus after its removal from the body. One cannot but think that the operators were fortunate above expectation in saving all the children, although of course one knows that the child may survive the death of the mother for a minute or two, and may therefore live for a short time after the separation of the uterus from the mother. Lecoq thinks it specially suitable for the following groups of cases: (1) Probable infection of the uterus when delivery cannot be safely performed by the natural passages; (2) fibroids or cancer complicating a pregnancy; (3) impending uterine rupture; (4) complete uterine inertia coming on when Cæsarean section is about to be done; (5) some cases of placenta prævia; and (6) osteomalacia. Professor Schickelé[92] doubts whether panhysterectomy without previous hysterotomy can always be done in the conditions named by Lecoq, and instances a fibroid growth of the cervix as an insurmountable difficulty; he did the operation once for cancer of the cervix, the child being already dead. There is one formidable objection to all hysterectomy operations superadded to Cæsarean section, and that is the compulsory

sterilisation of the patient which is involved; this may matter little in some instances, but in others, such as primiparas in which the section is being done for an indication not likely to recur, this consideration is far from negligible.

Instead of doing a panhysterectomy of the unopened uterus in potentially infected cases one may of course endeavour so to modify the hysterectomy after the extraction of the child as to make the risks of peritonitis less. It is for this purpose that Schumann[93] after making the usual vertical abdominal incision turns the unopened uterus out of the abdomen, covers it with a hot moist towel, and has it held well forward by an assistant; he then closes the cardinal layers of the abdominal parietes by sutures stopping only at the posterior border of the eventrated uterus; next he caulks with a gauze sponge the opening round the cervix through which the uterus projects to prevent leakage back into the abdomen; then he opens the uterus by the fundal incision of Fritsch and extracts the child; the ovarian and uterine vessels are ligatured, the broad ligaments are cut, and the uterus is amputated at the cervix leaving an ample stump; this cervical stump is now drawn together by continuous or interrupted sutures and the openings in the broad ligaments are closed; the gauze packing round the cervix is removed, the parietal peritoneum is sewn round the closed off uterine stump, leaving it entirely extraperitoneal; and finally, the closure of the abdominal incision is completed, the skin and muscle covering the cervical remnant. This operation may be regarded as a sort of Old Porro with modern refinements of technique, and is worthy of trial.

At the present time, therefore, there are three plans of dealing with the potentially infected uterus by abdominal section. There is first the employment of the conservative Cæsarean section, making the incision in the uterus high, but, in addition, endeavouring by various refinements of technique to prevent peritoneal spilling of the infected liquor amnii and to make impossible any leakage from the uterine interior through the closed incision. Not a few obstetricians (and the reviewer is one of them) think that in this way the best plan will be discovered. In other words, potential infection of the uterine cavity shall not be regarded as a complete bar to the doing of an ordinary Cæsarean section. Certain safeguards will be adopted such as the opening of the uterus outside the abdomen, the changing of gloves after the removal of the membranes and placenta, the careful sponging of the edges of the incisions, the walling off of the peritoneal cavity, etc. There is, second, the adoption of the low uterine incision along with the so-called extraperitoneal or transperitoneal method of performing the Cæsarean section. Theoretically, success ought to come along this path, but in actual practice there has been some

disappointment with the results. Difficulty in technique ought not to be, and will not be, a bar to the obstetrician testing thoroughly these plans; but it cannot be affirmed that the ideal operation has yet been devised, although Beck's method has much to commend it. In the third place, there is the plan of hysterectomy, the uterus being removed either unopened (as recommended by Lecoq) or after extraction of the child (as by other obstetricians). The chief criticism of this plan is its non-conservative character. In some cases, as in second or third Cæsarean sections, it may, indeed, be accepted as a convenient plan of sterilising the patient, but in other instances, as in the primipara with, say, placenta prævia, it is not beyond reproach. Of course, if by no other form of section can the potentially infected woman be delivered with safety, then it will be necessary to add hysterectomy in one form or another to the hysterotomy; but in the meantime obstetric ingenuity has not reached finality in other directions.

It remains to be said that in recent literature several papers have appeared in which local anæsthesia is recommended in Cæsarean section. Trout,[103] for instance, has employed it in 18 Cæsarean sections, infiltrating successively skin, fascia, and peritoneum. W. Mortimer Brown[14] has used it in cases of advanced cardiac disease, of severe toxæmia and impending eclampsia, and of pulmonary tuberculosis; but he gives no details of the manner in which the local anæsthesia is secured. Irving[53] combines the local anæsthesia with the injection of morphine and scopolamine, and recommends the plan in the graver complications of pregnancy associated with the necessity for doing Cæsarean section.

Among the comparatively little known and less practised complementary operations associated with the conservative Cæsarean section, one must surely reckon resection of the sacro-vertebral angle. Fossati[37] describes the operation, which may be done either purely as a prophylactic measure in the non-pregnant woman or (with more difficulty) at the same time as the Cæsarean section. The reviewer has furnished details of the technique in the *Encyclopædia Medica* (2nd Edition, 1921, vol. vii., p. 582).

LITERATURE.—[1] Andérodias, "Accouchement spontané après opération césarienne," *Bull. Soc. d'obstét. et de gynéc.*, 1920, ix., 259; *Gynéc. et obstét.*, 1921, iii., 50. [2] Applegate, J. C., "The Indications for Cæsarean Section based on an Analysis of Ninety-five Operated Cases," *Amer. Journ. Obstet.*, 1919, lxxx., 167, 225. [3] Baisch, K., "Der Kaiserschnitt beim engen Becken und bei Placenta prævia auf Grund von 105 Fällen," *Med. Cor.-Blat. d. würtemmb. ärztl. Landesver.*, 1919, lxxxix., 103. [4] Baisch, K., "Die Gefahren des Kaiserschnittsnarbe und ihre Verhütung," *Monatschr. f. Geburtsh. u. Gynaek*, 1920, liii., 57. [5] Bar, P., "Place qu'il convient d'attribuer a l'opération césarienne haute parmi les observations obstétricales," *Arch. mens.*

d'obstét. et de gynéc., 1919, viii., 49; *Ann. de gynéc. et d'obstét.*, 1919, 2 s., xiii., 421. [6] Bazely, Minnie W., "The Incision in Cæsarean Section" *Brit. Med. Journ.*, i. for 1920, 602. [7] Beck, A. C., "Observations on a Series of Cases of Cæsarean Sections done at the Long Island College Hospital during the past Six Years," *Amer. Journ. Obstet.*, 1919, lxxix, 197. [8] Beck, A. C., "The Advantages and Disadvantages of the Two-flap Low Incision Cæsarean Section, with a Report of Eighty-three Cases done by Fifteen Operators," *Amer. Journ. Obstet. and Gynec.*, 1921, i., 586, 636. [9] Bill, A. H., "Observations on the Problem of Hæmorrhage in Obstetrical Cases," *Amer. Journ. Obstet.*, 1919, lxxx., 708. [10] Boquel, A., "Hémorrhagies de la grossesse," *Arch. mens. d'obstét. et de gynéc.*, 1918, vii., 190. [11] Brodhead, G. L., "Two Cases of Extra-peritoneal Cæsarean Section for Contracted Pelvis," *Amer. Journ. Obstet.*, 1918, lxxvii., 993. [12] Brodhead, G. L., "Is Cæsarean Section justifiable in Eclampsia and Placenta Prævia?" *New York State Journ. Med.*, 1918, xviii., 389. [13] Brouha, M., "Faut-il réserver strictement l'opération césarienne abdominale au cas purs?" *Gynéc. et obstét.*, 1920, ii., 385. [14] Brown, W. M., "Cæsarean Section under Local Anæsthesia," *Amer. Journ. Obstet.*, 1918, lxxviii., 836. [15] Browne, F. J., "Pelvic Presentation in an Elderly Primipara; Version Unsuccessful; Cæsarean Section," *Internat. Clin.*, 1920, 30 s., ii., 286. [16] Brunner, K. "Kaiserschnitt wegen Blutung aus Varizen der Vagina. Zur Keimprophylaxis bei der Sectio caesarea transperitonealis," *Corr.-Blat. f. schweiz. Aertze*, 1919, xlix., 321. [17] Byers, Sir J., "Laparotomy for Ruptured Uterus; Cæsarean Section in Placenta Prævia," *Brit. Med. Journ.*, ii. for 1920, 202. [18] Chiaje, S. delle, "Sul taglio cesareo," *Riforma Med.*, 1919, xxxv., 760. [18a] Cochrane, R. C., "Technic of Abdominal Cæsarean Section," *Boston Med. and Surg. Journ.*, 1917, clxxvii., 410. [19] Conaway, W. P., "Cæsarean Section for Unusual Conditions," *Amer. Journ. Obstet.*, 1919, lxxix., 778. [20] Cornell, E. L., "Cæsarean Section for Placenta Prævia," *Surg. Clin.*, 1920, iv. 1081. [21] Cornell, E. L., "The Cervical or Krönig Cæsarean Section," *Illinois Med. Journ.*, 1920, xxxviii., 203. [22] Couvelaire, A., "Avenir obstétrical des femmes ayant subi la section césarienne portant sur le corps de l'uterus," *Gynéc et obstét.*, 1920, ii., 225. [23] Cova, E., "La mia perzonale esperienza sul taglio caesareao da una statistica di 74 operazioni personali," *Rassegna d'ostet. e ginec.*, 1919, xxviii., 241. [24] Cressy, A. Z. C., "Cæsarean Section for Placenta Prævia with Concealed Hæmorrhage," *Brit. Med. Journ.*, ii. for 1919, 706. [25] Creutz, C. G. ["Unusual Indications for Cæsarean Section"], *Finska läk.-sällsk. handl.*, 1917, lix., 1221. [26] Davis, A. B., "The Control of Uterine Hæmorrhage," *New. York Med. Journ.*, 1917, cvi., 149. [27] Davis, E. P., "The Hæmorrhages of Pregnancy," *Med. Record*, 1917, xci., 839. [28] Davis, E. P., "Elective Cæsarean Section," *Trans. Amer. Gynec. Soc.*, 1919, xliv., 249. [29] Dougal, D., "Cæsarean Section for Dystocia," *Lancet*, i. for 1920, 326. [30] Dudley, A. P., "Cæsarean Section," *New York Med. Journ.*, 1920, lxxii., 754. [31] Eberlé, D., "Transperitonealer cervicaler Kaiserschnitt bei vorzeitiger Placentalösung und engem Becken," *Zentrlbl. f. Gynäk.*, 1919, xlii., 1010. [32] Edgar, J. C., "Treatment of Eclampsia," *Journ. Amer. Med. Assoc.*, 1918, lxx., 1205. [33] Ehrenfest, H., "Cæsarean Section," *Amer. Med.*, 1902, iii., 64. [34] Emerson, N. W., "Cæsarean Section," *Boston Med. and Surg. Journ.*, 1920, clxxxii., 272. [35] Essen-Möller, E., "Sur les résultats et les indications de l'opération césarienne abdominale," *Arch.*

mens. d'obstét. et de gynéc., 1919, viii., 221 ; *Gynéc. et obstét.*, 1920, i., 457. [36] Essen-Möller, E., "Ueber die Erfolge und Indikationen des abdominales Kaiserschnitts," *Zentrlbl. f. Gynäk.*, 1920, xliv., 206. [37] Fossati, G., "La resezione dell angolo sacro-vertebrale come complemento al taglio cesareo conservatore," *Ann. di ostet. e ginec.*, 1919, xli., 12. [38] Foster, G. S., "A Plea for the Broader View of the Cæsarean Section," *Amer. Journ. Surg.*, 1919, xxxiii., 274. [39] Gaifami, P., "Il taglio cesareo transperitoneale," *Riv. di ostet. e ginec. prat.*, 1921, iii., 89. [40] Genge, G. G., "Cæsarean Section for Eclampsia," *Brit. Med. Journ.*, ii. for 1920, 976. [41] Grosse, A., "Un cas d'opération césarienne pour insertion vicieuse de placenta," *Ann. de gynéc. et d'obstét.*, 1918-19, xiii., 577, 753. [42] Grosse, A., "Trois accouchements spontanés après opération césarienne," *Gynéc. et obstét.*, 1920, i., 465 ; ii., 81. [43] Gueniot, P., "A propos de l'opération césarienne dans le cas de placenta prævia," *Gynéc. et obstét.*, 1920, i., 463. [44] Harrar, J. A., "Interference in Pre-eclamptic Toxæmia," *Trans. Amer. Assoc. Obstet. and Gynec.*, 1918, xxx., 263. [45] Hellier, J. B., "Treatment of Placenta Prævia," *Practitioner*, 1917, xcviii., 25. [46] Holland, E., "Rupture of Cæsarean Section Scar in Subsequent Pregnancy or Labour," *Lancet*, ii. for 1920, 591. [47] Holland, E., "Rupture of the Cæsarean Section Scar in Subsequent Pregnancy or Labour," *Brit. Med. Journ.*, i. for 1920, 705. [48] Hundgen, P., "Zwei seltene Indikationen zur Sectio caesarea," *Deutsche med. Wochenschr.*, 1919, xli., 1020., [49] Ill, E. J., "The Alcoholic Drain in Septic Cases requiring Cæsarean Section," *Amer. Journ. Obstet.*, 1918, lxxvii., 83, 300 ; *Trans. Amer. Assoc. Obstet. and Gynec.*, 1918, xxx., 270. [50] Ingraham, H. C., "Cæsarean Section for Eclampsia," *Amer. Journ. Obstet.*, 1918, lxxvii., 1000. [51] H. C. Ingraham "Three Cases of Post-mortem Cæsarean Section," *Amer. Journ. Obstet.*, 1918, lxxvii., 145. [52] Ipsen, "Section césarienne spécialement dans les cas de l'éclampsie et de placenta inséré sur le segment inférieur," *Gynéc. et obstét.*, 1920, ii., 46. [53] Irving, F. C., "Cæsarean Section under Local Anæsthesia combined with Morphine and Scopolamine Narcosis," *Boston. Med. and Surg. Journ.*, 1920, clxxxii., 578. [54] Jefferson, J. C., "The Technique of Cæsarean Section," *Practitioner*, 1917, xcix., 562. [54a] Kellogg, F. S., "Cæsarean Section—Overdone," *Boston Med. and Surg. Journ.*, 1916, clxxiv., 457. [55] Jones, A., "A Plea for more Frequent Use of Cæsarean Section, *Brit. Med. Journ.*, ii. for 1921, 75. [56] Kerr, J. Monro, "Rôle of Cæsarean Section, in Midwifery," *Lancet*, ii. for 1921, 502. [57] Kickham, C. J., "Ruptured Uterus in Previously Cæsareanised Patient ; with Report of Case where Fœtus remained Intact within Membranes following Rupture," *Boston Med. and Surg. Journ.*, 1920, clxxxiii., 602. [58] Kosmak, G. W., "Treatment of Certain Cases of Placenta Prævia by Conservative Measures," *Trans. Amer. Gynec. Soc.*, 1919, xliv., 263 ; *Bull. Lying-in Hospital City of New York*, 1920, xii., 51. [59] Langrock, E. G., "Extraperitoneal Section for Contracted Pelvis," *Amer. Journ. Obstet.*, 1918, lxxvii., 996. [60] Laurie, R. D., "Cæsarean Section for Placenta Prævia with Concealed Accidental Hæmorrhage," *Brit. Med. Journ.*, i. for 1920, 220. [61] Lecoq, R., "L'accouchement par hystérectomie sans ouverture préalable de l'utérus," *Ann. de gynéc. et d'obstét.*, 1919, xiii., 540 ; *Thèse*, Paris, 1919. [62] Lequeux, "Deux cas de placenta prævia traités par la césarienne," *Gynéc. et obstét.*, 1920, i., 303. [63] Ley, R. L., "Cæsarean Section for Eclampsia, followed by Pyosalpinx," *Lancet*, ii. for 1920, 1051. [64] Lichtenstein, F., "Intraperitonealer

cervicaler Kaiserschnitt bei verschleppter Querlage," *Zentrlbl. f. Gynäk.*, 1920, xliv., 343. [65] Lichtenstein, F., "Der Zervicale Kaiserschnitt mit Berucksichtigung der Spätresulte und der Perforation des lebenden Kindes vor und nach demselben.," *Arch. f. Gynaek.* 1920, cxii., 15-69. [66] Licht, F. J., and Calicchio, D. J., "An Unusual Monster delivered by Cæsarean Section," *Journ. Amer. Med. Assoc.*, 1921, lxxvii., 622. [67] Lönne, F., "Zur Indikation und Prognose des Kaiserschnitts," *Zentrlbl. f. Gynäk.*, 1919, xliii., 501. [68] Losee, J. R., "The Cæsarean Scar," *Amer. Journ. Obstet.*, 1917, lxxvi., 1. [69] Lyon, E. C., "Delivery by Cæsarean Section after a Previous Normal Labour," *Amer. Journ. Obstet. and Gynec.*, 1921, i., 746. [70] Maclean, E. J., "Degree of Absorption of Silk Sutures after Cæsarean Section," *Journ. Obstet. Gynec. Brit. Empire*, 1921, xxviii., 282. [71] M'Glinn, J. A., "Extraperitoneal Cæsarean Section," *Amer. Journ. Obstet. and Gynec.*, 1921, i., 45, 85. [72] M'Pherson, Ross, "Conservative Treatment of Eclampsia," *Trans. Amer. Assoc. Obstet. and Gynec.*, 1918, xxx., 232. [73] Magalhães, F., "Operãcão cesariana," *Brazil-med.*, 1920, xxxiv., 180. [74] Martius, H., "Der abdominale Kaiserschnitt," *Ztschr. f. Geburtsh. u. Gynäk.*, 1920, lxxxiii., 160. [75] Martius, H., "Der prophylactische Kaiserschnitt," *Zentrlbl. f. Gynäk.*, 1921, xlv., 161. [76] Mason, N. R., "Vaginal Delivery after Cæsarean Section," *Boston Med. and Surg. Journ.*, 1917, clxxvi., 127. [77] Neve, E. F., "Cæsarean Section in Osteomalacia," *Practitioner*, 1919, ciii., 453. [78] Oliva, L. A., "Taglio cesareo transperitoneale in donna infetta e gia operata di taglio cesareo classico," *Riv. d'ostet. e ginec. prat.*, 1920, ii., 502. [79] Parke, W. E., "Cæsarean Section in the Treatment of Eclampsia," *Amer. Journ. Obstet.*, 1918, lxxvii., 948, 977. [80] Payne, R. L., "The Treatment of Placenta Prævia, with Special Consideration of Cæsarean Section," *Amer. Journ. Surg.*, 1916, xxx., 363. [81] Pery, "Dix cas de césarienne simple ou suivie d'hystérectomie," *Gaz. hebd. d. sc. méd. du Bordeaux*, 1920, xli., 57. [82] Pestalozza, E., "Il taglio cesareo nell' utero doppio," *Riv. di ostet. e ginec. prat.*, 1921, iii., 1. [83] Potocki, "Dystocie causée par la corne non-gravide rétroflechie d'un uterus didelphe ayant nécessité l'opération césarienne," *Gynec. et Obstet.*, 1920, i., 298; ii., 23. [84] Poucher, J. W., "Pre-eclamptic Cæsarean Section," *Trans. Amer. Assoc. Obstet. and Gynec.*, 1918, xxx., 227. [85] Quigley, J. K., "Accidental Hæmorrhage, Cæsarean Section," *Trans. Amer. Assoc. Obstet. and Gynec.*, 1921, xxxiii., 109. [85] Rhomberg, B., "Plötzlicher Tod während der Geburt bei Status thymicolymphaticus, Sectio cesarea post mortem mit lebendem Kinde," *München med. Wochenschr.*, 1919, lxvi., 263. [87] Richter, "300 klassische Kaiserschnitte (1882-1914)," *Arch. f. Gynaek.*, 1920, cxii., 70. [88] Rongy, A. J., "Indications for Cæsarean Section," *Trans. Amer. Assoc. Obstet. and Gynec.*, 1919, xxxi., 174. [89] Rossier, "Eclampsie," *Rev. méd. de la Suisse Romande*, 1918, xxxviii., 357. [90] Rouffart, M. E., "De la valeur des differentes incisions dans les laparotomies en gynecologie et en obstétrique," *Arch. mens. d'obstét. et de gynéc.*, 1919, viii., 577. [91] Routh, A., "On Cæsarean Section in the United Kingdom," *Journ. Obstet. and Gynec. Brit. Empire*, 1911, xix., 1-233, 235-252. [92] Schickelé, G., "Les interventions obstétricales chirurgicales au cours de l'accouchement," *Gynéc. et obstét.*, 1920, i., 19. [93] Schumann, E. A., "A Modification of the Technic of Cæsarean Section with Hysterectomy," *Amer. Journ. Obstet.*, 1918, lxxvii., 297, 446. [94] Schumann, E. A., "The Cæsarean Section. Its Indications and Limitations in the

Obstetrics of To-day," *Amer. Journ. Obstet.*, 1919, lxxix., 371. [95] Schwarz, B., "Symphysiotomie oder Section Caesarea," *Zentrlbl. f. Gynäk.*, 1921, xlv, 521. [96] Fletcher Shaw, and Others, "Treatment of Ante-partum Hæmorrhage," *Brit. Med. Journ.*, i. for 1920, 672. [97] Skeel, A. J., "Cæsarean Section: its Indications and Technic," *Trans. Amer. Assoc. Obstet. and Gynec.*, 1920, xxxii., 171. [98] Slemons, J. M., and Johnson, J. M., "Cæsarean Section under Procain Anæsthesia," *Journ. Amer. Med. Assoc.*, 1920, lxxiv., 882. [99] Smith, A. L., "The Improved Cæsarean Section," *Practitioner*, 1917, xcix., 541. [100] Stockaert, "Grossesse compliquée d'hydramnios," *Gynéc. et obstét.*, 1920, ii., 269. [101] Tait, Lawson, "The Surgical Aspects of Impacted Labour," *Brit. Med. Journ.*, i. for 1890, 666. [102] Titus, P., "Repeated Cæsarean Section," *Trans. Amer. Assoc. Obstet. and Gynec.*, 1921, xxxiii., 371. [103] Trout, H. H., "Cæsarean Section, Local Anæsthesia," *Surg. Gynec. and Obstet.*, 1918, xxvii., 95. [104] Tweedy, H., "Treatment of Ante-partum Hæmorrhage," *Brit. Med. Journ.*, i. for 1920, 672. [105] Vanverts, J., "Fibrome uterin prævia ; opération césarienne au début du travail," *Bull. Soc. d'obstét. et de gynéc. de Paris*, 1920, ix., 268. [106] Vanverts, J., and Paucot, H., "De la suture en double cercle et de la péritonisation dans l'opération césarienne conservatrice," *Gynéc. et obstét.*, 1920, i., 320. [107] Welton, T. S., "Double Flap Low Cæsarean Section Results," *Amer. Journ. Obstet. and Gynec.*, 1921, i., 350, 379 ; *Trans. Amer. Asssoc. Obstet. and Gynec.*, 1921, xxxiii., 64. [108] White, Clifford, "Unusual Conditions of the Sutures after Cæsarean Section," *Journ. Obstet. and Gynec. Brit. Empire*, 1921, xxviii., 280. [109] Whitehouse, H. B., "The Indications for Cæsarean Section," *Lancet*, i. for 1920, 235. [110] Williams, J. T., "Delivery by the Natural Passages following Cæsarean Section," *Amer. Journ. Obstet.*, 1919, lxxx., 435. [111] Williams, J. Whitridge, "The Abuse of Cæsarean Section," *Surg. Gynec. and Obstet.*, 1917, xxv., 194. [112] Williams, J. Whitridge, "A Critical Analysis of Twenty-one Years' Experience with Cæsarean Section," *Bull. Johns Hopkins Hospital*, 1921, xxxii , 173. [113] Young, J. V. D., "Cæsarean Section for Contracted Pelvis, Double Uterus, and Multiple Fibroids," *Amer. Journ. Obstet.*, 1918, lxxviii., 109.

OBITUARY

THE LATE DR W. G. W. SANDERS,

M.B. (Edin.), M.D. (Montpellier), F.R.C.P.E.

One of the most poignant sorrows, inseparable from longevity, is the loss of those who, while marking time in our ranks, have won our admiration and regard, and who, having attained to high place in the profession, are prematurely called to their rest—their brightest hopes apparently blighted and their best work apparently unaccomplished. Thus it is that we mourn the death of Gordon Sanders, who died in Cannes, on 2nd December, from influenzal pneumonia. He was by birth and heredity a doctor; for he was the grandson of a physician well known in Edinburgh, and the son of one who was long physician to the Infirmary, was at one time lecturer on physiology in the extra-mural school, was ultimately Professor of Pathology in the University, and at the time of his premature death—for he died in his early fifties—he was the leading consulting physician in Scotland.

Gordon was educated at Fettes College, and the impression he made there was notable, for I recall the remark of one of his masters, that "of his class of boys Rowlatt and Sanders would go furthest," and in this he was probably right, for Rowlatt is now one of the ablest judges on the English Bench, and Sanders attained a foremost place as a clinical physician. The energy and ability displayed in his school days carried him to high rank among his fellow-students at the University, for he obtained many class distinctions. He was elected Senior President of the Royal Medical Society, and when he graduated M.B., C.M. in 1889 he did so with first-class honours. His outstanding powers as a student lay in such quickness of intellect and capacity for concentration as enabled him with rapidity to master his subject, and the clinical instinct he displayed at the bedside, for he possessed that sixth sense which belongs to the realm of inspiration, and which, like the twig of the water diviner, indicates the position where that which is sought after had best be looked for! The winter following his graduation he acted as a Resident Physician in the Infirmary, and during the summer he held a similar position in the Hospital for Sick Children. With a view to increasing his knowledge of mental and nervous diseases, he held for a time the post of pathologist at the Rainhill Asylum, and there he acquired in the post-mortem room experience which was of high value to him in after-life. Determined to carry on his well-founded family tradition he returned to Edinburgh, and was appointed Clinical Tutor in the Medical Wards of the Royal Infirmary—a position he was peculiarly fitted to occupy, for he possessed an excellent knowledge of medicine and pathology, of the clinical methods which were employed

in the investigation of the problems connected with them, and a gift of great clearness in teaching which, like his intuition at the bedside, was probably a happy gift of heredity. While he did his work in this field so ably as to leave no doubt as to his future position in the school in which he had been trained, he began to acquire private practice—a practice which, had ill-health not intervened, would have grown great, as his success in Cannes has abundantly demonstrated.

In the latter half of 1893 there came to him an unlooked-for opportunity of publicly showing the powers which were his, for through the action of a shrewd lawyer friend — who had certainly weighed him mentally—he became a medical witness for the defence in the famous Ardlamont case. Here the issue lay between murder and accidental death, through a gun-shot wound of the head, and the chief points in dispute were the direction in which the charge of shot passed and the distance at which it was fired. Sanders had no personal knowledge of gunning, and the very slightest experience of gun-shot wounds, but by study, experiment, and deduction he arrived at such definite conclusions on the disputed points that he was able to give his evidence so clearly, so confidently, and yet with such caution and deliberation that it remained well-nigh unshaken, and contributed in large measure to the success of the defence, for Monson—the accused—was acquitted by a verdict of "Not Proven." He certainly won a personal triumph here, for he was opposed to the ablest and most conspicuous of legal talent, and the testimony of the highest medico-legal authorities in Scotland, and he held his own against them both, making a mark as to his high mental capacity which would not readily have been effaced. He was then 28, and was acting as assistant to the Professor of Medicine – a position he was still holding when the blow fell which drove him from the places of his youth and his desire, for he developed some pulmonary mischief from which he suffered more or less all the remaining years of his life, and which he sustained with so notable a courage as in anxious circumstances connected with it, made it amount almost to indifference.

Cannes became his choice for his future, and he arrived there in 1895, when he found it imperative that before he could enter upon practice he must obtain a University Medical Degree. His ability, his knowledge, and his determination made him easily equal to the task, and by a few months' residence at the University of Montpellier he became one of its graduates. Once fairly in the saddle his qualities were quickly recognised; for, added to a masterly knowledge of his profession, he possessed a singularly bright and joyous personality, and anyone who at first sight might have been impressed by his, at times, almost solemn appearance, became quickly undeceived when they noted the twinkle in his eye, his genial smile, and the humour

and brilliancy of his conversation. Certain local conditions favoured his start in practice, and he was able to take full advantage of them; for, as a physician, he had fine intellectual qualities, he had perspicacity —accurate, immediate perception—he had sagacity in judgment—he had efficacity, and he had audacity in its relationship to the employment of medicines in treatment. Two further gifts he had of inestimable value to the doctor; he had very highly developed that gift of instinct to which I have already referred, and which enabled him to make a diagnosis very quickly—a process which with some men seems an unconscious one, but is no doubt the outcome of careful clinical observation and of long training of the reason; and he had also *nous*—that promptitude which combined with knowledge is, in emergency, of highest value, and rendered his presence in the sickroom at times a veritable benediction.

He was concerned with medicine in all its branches, but in some measure, due to his friendship with Sir James Mackenzie, he found in the Diseases of the Heart his fullest interest, and he employed constantly that most ingenious and valuable instrumental method of investigation, which will always bear Mackenzie's honoured name. He was the last but one in active work of that band of men of whom Philip Frank and Charles George Bright—once names to conjure with—were the earliest, who, with British degrees, and having won their spurs and the wisdom of experience in other fields of work, had been compelled by ill-health to seek the sunny shores of the Mediterranean, and who, through their efficiency and their personal character, had won for their profession in a foreign land a most honourable and enduring tradition, and to the growth of this tradition Sanders added his full quota, for he was a *persona grata* with many French practitioners.

During the War he had his full share of toil and of sorrow, for he did much excellent work among the soldiers of France, who, suffering from tuberculosis, were sent to Cannes for treatment; and, like so many others, he suffered bereavement and anxiety in connection with his family circle, for his second son—a captain in one of the regular battalions of the West Yorks—disappeared with his whole company in the terrible retreat of March 1918; and his eldest son, an officer in the Flying Corps, shot down behind their lines, was for long a prisoner in German hands. These events wrote an indelible record on his affectionate and sensitive nature, and he cast back sadly to the days when he had a "complete family." His marriage to a daughter of the Rev. Charles Darnell was the happiest event in his life, for by her devotion and care she undoubtedly prolonged his most valuable life and added enormously to its efficiency. To her and to the members of her family—two of whom have lately joined the profession—our warmest sympathy goes out.

Obituary

He loved the country, and in his earlier years was fond of golf and of a ride across the quiet moorlands, while his powers of observation and his lively and interesting conversation made him a most delightful companion in a rural walk. Looking back upon more than forty years of warm friendship, of which twenty were passed in most intimate relations, professionally, I would record of him that he was pure, high-minded, gentle, true, and lovable, that he walked righteously, and spoke uprightly, that he was indeed a truly good man. And now his mortal remains rest in one of the most beautiful of God's acres, where the southern sunshine he loved will always irradiate his grave, a grave upon which many will, in reverence and affection, lay their tribute of flowers, as I do this tribute of falteringly written words. But he still lives in that great cloud of witnesses by which we are surrounded as we pursue our earthly race; and in the cherished memories of many who knew and loved him in his school and college days—of many who knew and admired him in the times of his brilliant success—and of that great multitude to whom it was granted him to bring hope, and healing, and happiness.

"In perfect honour, perfect truth,
And gentleness to all mankind,
You trod the golden path of youth,
Then left the world and youth behind.
Ah, no! 'Tis we who fade and fail—
And you from Time's slow torments free
Shall pass from strength to strength and scale
The steeps of immortality.

Dear heart, in that serener air,
If blessed souls may backward gaze,
Some slender work of memory spare
For our old happy moorland days.
I sit alone, and memory fills
My breast with pain that shall not die,
Till once again o'er greener hills
We ride together, you and I."

J. A. MacDougall.

NEW BOOKS

Principles of Therapeutics. By OLIVER T. OSBORNE, M.A., M.D., Professor of Therapeutics, Yale University. Pp. 881. London: W. B. Saunders Company. 1921. Price 35s.

This book is intended to be an up-to-date conspectus of the science of rational therapeutics. It covers a wide field, and though chiefly concerned with drug therapy, there are sections dealing with dietetics, with the use of various physical methods in treatment, and with medical ethics. Professor Osborne has given special attention to the endocrine glands and organotherapy, and no fewer than 113 pages of the book have been devoted to this subject. He values with confidence, however, a great many statements that are based upon insufficient evidence, and consequently there is a tendency to advise the use of organ extracts in a great many conditions where the therapeutic indications are extremely problematical. This is particularly the case with regard to the employment of thyroid, mammary gland, and corpus luteum extracts. It is to be deplored that the author has not been able to avoid a good deal of the confusion and loose thinking which prevail in the literature upon "endocrinology" at the present time. For example, referring to the relationship between the secretion of the thyroid and the internal secretion of the pancreas, we are unable to understand how the conclusion is arrived at that "when the thyroid subsecretes the pancreas often oversecretes, and glycosuria results."

In Part II. a list is given of the valuable drugs in the United States Pharmacopœia. There may be some difference of opinion as to whether the selection is a wise one, and several substances have been included which even the author himself admits to be useless.

An attempt is made to state more precisely and in greater detail than is given in most books the indication for the use of the various drugs, and this is accompanied by a brief account of those of their pharmacological actions which have a direct bearing upon their employment in practical therapeutics. In this connection, however, we regret to see unqualified statements which should be eliminated from all reliable text-books upon the subject: such, for example, as that strychnine stimulates the heart, and that the sodium salts of bromine and iodine are less depressant than the potassium ones.

It is also surprising to read that "but little strophanthin action on the heart can be obtained from strophanthus by the mouth," and that the apparent good effect of strophanthus in some cases was due to the administration of digitalis having been stopped.

The aims of the author, as expressed in his preface, are admirable; but we think he has allowed to pass too many statements which have

the appearance of authority, and which have not been subjected to sufficient critical examination.

Pulmonary Tuberculosis. By Sir James Kingston Fowler, K.C.V.O., etc. Pp. xiv + 284, with 52 illustrations. London: Macmillan & Co., Ltd. 1921. Price 20s. net.

The author has succeeded in giving his readers a most interesting and up-to-date account of the subject, without going into laborious details. He aims at giving as much practical advice as possible drawn from a life-long study of the subject. The personal touch is clear throughout, and the author gives his own view on many controversial points in no uncertain manner. It is a delightful book to read, because the author adopts a vigorous, if at times unorthodox, style in presenting his opinions.

The early chapters deal with questions of historical interest, the rôle of heredity, questions as to infection, incidence, and mortality, and a description of "para-tuberculosis"—a term used to denote bovine tubercle and scrofula. In summing up his views on the difficult questions of heredity in relation to tubercle, the author considers any attempt at scientific precision is doomed to failure. He fully states his reasons for this belief. The practical questions of every-day medical work arising out of infection are summarised in a short catechism, in which the author gives his views in clear and concise terms.

The author's views, from post-mortem statistics, as to the presence of "obsolete tubercular lesions" are rather at variance with those of the late Sir Wm. Osler, and more recent statistics from Switzerland.

The classification and general description of symptoms and physical signs are based on chapters from Fowler and Godlee's book on *Diseases of the Lungs*, published in 1898. On turning to the question of hilum tuberculosis we find the author expressing his views thus: "It appears to be a shadow first seen in a darkened room and not yet clearly recognised in the daylight of the post-mortem room." In an excellent chapter dedicated to the memory of Otto Walther the author administers a much needed corrective to the croaking pessimists who tell us that sanatorium treatment is a failure. He wonders if such people ever grasped the true meaning of such treatment, and advises them, in another part of the book, to visit the Loomis Sanatorium of New York.

A chapter is devoted to the subject of artificial pneumothorax in which its field of utility is defined.

The author considers tuberculin of no practical value in diagnosis or treatment. An excellent summary of Dr A. Delitte's paper on the "Œuvre Grancher" is given. This paper was read in English by Delitte at the International Tuberculosis Conference in London in

July 1921. The writer summarises his conclusions under the heading of "obiter dicta."

A useful, but not quite accurate, list of sanatoria and hospitals with beds for tuberculosis patients, concludes a thoroughly practical work, which will be of much use to the general physician, as well as to those more specially interested in the tuberculosis problem.

The Stomach and Abdomen. By WILLIAM RUSSELL, M.D., LL.D. Pp. xii + 329. London: Baillière, Tindall & Cox. 1921. Price 15s. net.

To many of his old students, as well as to the wider circle who had not the good fortune to have Dr Russell as their guide in the problems of clinical medicine, this volume will make a strong appeal. It is the fruit of years of observation of patients, careful study of their cases, and reflections on the lessons taught—years in which, as "experience was tested and re-tested, the problems became simpler and the points essential to correct diagnosis clearer." Indeed, simplification is one of the great merits of the book. It gives the principal digestive disorders in bold clear outlines, and does not harass the conscientious reader with a multitude of details. The general plan of the book, like its style, is clear and logical. The great bulk of cases of gastric disorder not due to organic disease are grouped under the heads of hypo- and hyper-chlorhydria, and in insisting on the importance of the first of these, especially, Dr Russell does good service, for while hyper-chlorhydria and its symptoms are familiar to most, the same does not apply to the phenomena due to deficient secretion. So called "flatulent dyspepsia" is definitely categorised as air-swallowing, and the recognition of this is a definite advance inasmuch as it dispels any lingering belief in obscure gastric fermentation. The ground being thus cleared, the important subjects of gastric and duodenal ulcer, gastric dilatation, visceroptosis, and malignant disease are discussed. The paragraphs dealing with the physical examination of the stomach and abdomen are particularly good, and serve to show that to so practised and accurate a clinician as the author radiographic examinations are often superfluous and always subservient to other clinical findings. The second part of the book deals with the other abdominal viscera—spleen, liver, and kidneys. No attempt is made to present an exhaustive account of these; they are taken up from the standpoint of their relation to abdominal disease in particular. Thus the kidney affections referred to are mainly those causing enlargement, or symptoms chiefly referable to the urinary tract such as pyonephrosis or bacterial infections.

Professor Russell's book is a really valuable contribution to clinical medicine, and his grouping of disorders of digestion constitutes a definite gain in precision as regards their diagnosis and treatment.

FOREIGN BOOKS

Traite Pratique des Maladies des Enfants du Premier Age. Dr Gaston Variot. Pp. 1148. Paris: Libraire Octave Doin. 1921.

In this work Dr Variot gives the results of his experience in the diseases of infants which he has gained during his thirty years as a physician in the Children's Hospitals in Paris. It is a very complete treatise on the diseases peculiar to the first two years of life, and is a worthy continuation of the traditions of French pediatrics. One cannot fail to be impressed with the very personal character of the work, which is manifestly the outcome of a great deal of thought and careful clinical observation on the part of the author. For those who desire to understand the modern French school of teaching in all matters relating to the diseases of infants this volume can be most confidently recommended.

Die Therapie an den Bonner Universitätskliniken, herausgegeben von Prof. Dr Rudolf Finkelnburg (Bonn: A. Marcus & E. Webers Verlag, 1920), contains a detailed description of the various therapeutic measures which are employed at the University Cliniques of Bonn. A number of writers contribute to the sections of which they are the directors. Not only is the field of general medicine covered, but also there are chapters on Neurology, Diseases of the Eye, Ear, Nose, and Throat, and Gynecology. This volume is very complete, and offers a well co-ordinated review of therapeutic measures which are carried out in a large University Clinique.

Les Antigènes et les Anticorps, by M. Nicolle (Paris: Masson et Cie, price 4 francs 50), contains the Harben lectures delivered by the author in London in 1920. In it he has not only presented a brief exposition of the fundamental conceptions of immunity, but he has aimed at a direct application of these theories to the diagnoses and treatment of certain diseases due to bacteria. This necessitates an acceptance as facts of things that one would prefer to regard as theories. His statements are clear, dogmatic, and debatable, and the book is worth reading if only as a stimulus to opposition.

NOTES ON BOOKS

Annals of Medical History, vol. iii., No. 1, edited by Francis R. Packard, M.D. (Baillière, Tindall, & Cox), price $8 per year. The first number of this Quarterly for 1921 contains articles on the "Collection of the Boston Phrenological Society," "An Ancient Egyptian Prescription for Hysteria," "Elizabeth Fry," "Leonardo da Vinci," "Sir William Osler," "Shakespeare and the Practice of Medicine," "An Assyro-Babylonian Treatise," "The Giving of Medical Degrees in the Middle Ages," "Thomas Bartholin," etc. This number maintains the high standard of its predecessors.

Arabian Medicine, by Edward G. Browne, F.R.C.P. (Cambridge University Press, price 12s.), consists of the four Fitzpatrick lectures delivered by the author in 1919 and 1920, and gives a brief but comprehensive account of medical science as practised by the peoples who used the Arabic language in the Middle Ages. It is less voluminous than the well-known *Histoire de la Médecine Arabe* of Lucien Leclerc, but contains the results of more recent research, is scholarly in spirit, entertaining in its accounts of clinical cases, and often very instructive. A good account is given not only of the literary form of the Arabic medical works, but of their curious ideas of pathology and of the psycho-therapeutic measures which were much used by the Arabian physicians and which merit study at the present day.

For those who wish to be in constant touch with French medical literature the *French-English Medical Dictionary*, by Alfred Gordon, A.M., M.D. (Paris), (London: H. K. Lewis & Co., Ltd.), has been published. It is easy of reference, the arrangement and type being excellent. Each French word is accompanied by a combination of letters in English giving the pronunciation. The price is 16s. net.

Murrell's *What to do in Cases of Poisoning* (Lewis & Co., Ltd., price 4s. 6d.), appears in its twelfth edition, revised by Dr P. Hamill, who has added sections on new poisons and brought the whole work up to date.

Chemistry and Civilisation, by Allerton S. Cushman (E. & S. Livingston, price 15s), is intended for the lay reader, and is designed to indicate what chemistry has done, is doing, and hopes to accomplish for mankind in the future.

We have received from Messrs Churchill, the seventeenth edition of Chavasse's *Advice to a Wife*, edited by Dr G. T. Wrench.

The second edition of Dr K. Menzies' *Autoerotic Phenomena in Adolescence* (H. K. Lewis & Co., Ltd., price 5s.) is practically a reprint of the first edition, recently noticed in these pages.

ANALYTICAL NOTES

PURE PROTEINS FOR TESTING PROTEIN REACTION.
(DUNCAN, FLOCKHART & CO.)

CONSIDERABLE difficulty has existed in obtaining in this country pure proteins for testing the sensitiveness of patients suffering from asthma and other disturbances believed to be due to anaphylaxis. Messrs Duncan, Flockhart & Co. are, we believe, the first British manufacturers to supply this deficiency, and they now issue a number of different proteins—meat, fish, vegetable, and miscellaneous—in capillary tubes in a form suitable for the cutaneous test. We have had an opportunity of making use of some of these proteins, and have found them (so far as present experience admits of our opinion being expressed on a diagnostic method, the value of which is *sub-judice*) quite trustworthy. The name of the makers is a sufficient guarantee of the purity of these products, and it is to be hoped that they will receive a thorough trial at the hands of the medical profession.

COAGULEN-CIBA (CLAYTON ANILINE CO., LTD.)

COAGULEN is a hæmostatic prepared from the blood platelets by the Society of Chemical Industry in Basle. It is supplied in tablets, which, when dissolved in 50 c.c. distilled water give a 1 per cent. solution in normal saline; in sterile ampoules containing 1.5 c.c. of 3 per cent. solution for hypodermic injection; and in larger ampoules containing 20 c.c. of the same solution. The new preparation is founded on physiological principles, and appears to be worthy of extensive trial.

SEALAND TRADING COMPANY, LIMITED.

FROM this Company have come to hand several preparations for which they are agents, and as these are to some extent novelties, we have pleasure in drawing attention to them. "Sanogyl" Tooth-paste is an agreeable tooth-paste containing neosalvarsan, the object being to destroy the spirochætes to which some form of gingīvītis and possibly pyorrhœa are due. "Sanoram," an antiseptic, based on fluorine, is said to be absolutely non-irritating, owing to the fact that it does not coagulate albumen *Antedysenterie*, and *anti-typhoid* pastilles are prepared according to the directions of Besredka, and it is claimed for them that they afford a successful means of vaccination by oral administration. *Tuberculous egg prepared antigen* is prepared according to the formula of Besredka, and is intended for a complement deviation test for tuberculosis. The antigen is supplied in sealed tubes and keeps indefinitely.

PHYLLOSAN
(CHLOROPHYLL AND CHEMICAL CORPORATION, LIMITED.)

THE value of green vegetables in anæmic conditions has always been insisted on, especially in Central Europe. Chlorophyll, as is well known, is related structurally to hæmoglobin. Phyllosan is a concentrated chlorophyll, which is said by its discoverer to be readily assimilated in large quantity. There would thus appear to be justification for its employment in conditions of anæmia.

Books Received

HORLICK'S MALTED MILK

THE proprietors of this well-known food issue a booklet suggesting that their preparation has certain advantages over the ordinary cereal for suspending barium or bismuth in radiology of the alimentary canal. The usual bismuth meal is often distasteful, and the proposal to use Horlick's Malted Milk is one which should be considered favourably.

BOOKS RECEIVED

ACUTE EPIDEMIC ENCEPHALITIS: An Investigation by the Association for Research in Nervous and Mental Diseases (*Paul B. Hoeber*) $2.50

BYAM, W., and R. G. ARCHIBALD. Edited by. The Practice of Medicine in the Tropics. Vol. I. (*Oxford Medical Publications*) £4 4s.

CATHCART, CHARLES W. Training and How to Keep always Fit. (*E. & S. Livingstone*) 2s.

CRAIG, MAURICE. Nerve Exhaustion. . . . (*J. & A. Churchill*) 6s.

DAWSON, E. RUMLEY. The Causation of Sex in Man. Third Edition (*H. K. Lewis & Co., Ltd.*) 7s. 6d.

HOCH, AUGUST. Benign Stupors . . (*Cambridge University Press*) 14s.

HUTCHISON, ROBERT, and JAMES SHERREN, Edited by. An Index of Treatment. Eighth Edition. (*John Wright & Sons, Ltd.*) 42s.

M'KEE, GEORGE MILLER, X-Rays and Radium in the Treatment of Diseases of the Skin. (*Henry Kimpton*) 45s.

MACLEAN, HUGH. Modern Methods in the Diagnosis and Treatment of Renal Disease. (*Constable & Co., Ltd.*) 8s. 6d.

MACPHERSON, Sir W. G. History of the Great War: Medical Services General History. Vol. I. (*H.M. Stationery Office*)

MILROY, J. A., and T. H. MILROY. Practical Physiological Chemistry. Third Edition (*Wm. Green & Sons, Ltd.*) 21s.

MOORE, IRWIN. Intrinsic Cancer of the Larynx and the Operation of Laryngo-Fissure. (*London University Press*) 21s.

MUTHU, DAVID C. Pulmonary Tuberculosis: Its Etiology and Treatment (*Baillière, Tindall & Cox*) 12s. 6d.

OSBORN, HAROLD Dental Mechanics . (*John Wright & Sons, Ltd.*) 5s.

PATON, D. MONTGOMERIE. Hormone Therapy (*Baillière, Tindall & Cox*) 7s. 6d.

PERMEATING MASTOID MENINGITIS . (*John Wright & Sons, Ltd.*) 1s.

REPORT ON THE HEALTH OF THE ARMY FOR THE YEAR 1914. Vol. LVI. (*H.M. Stationery Office*) 16s.

ROSENAU, MILTON J. Preventive Medicine and Hygiene. Fourth Edition (*D. Appleton & Co.*) 45s.

SCHACHNER, AUGUST. Ephraim McDowell, "Father of Ovariotomy." (*J. B. Lippincott Company*) 25s. net.

SUTTON, RICHARD L. Diseases of the Skin. Fourth Edition. (*Henry Kimpton*) 50s.

THOMSON, ALEXIS, and ALEX. MILES. Manual of Surgery, Vol. III. Sixth Edition (*Oxford Medical Publications*) 12s. 6d.

TRANSACTIONS OF THE AMERICAN GYNECOLOGICAL SOCIETY. Vol. XLV. 1920 (*Wm. J. Dornan*)

TRANSACTIONS OF THE AMERICAN SURGICAL ASSOCIATION. Vol. XXXVIII. (*W. J. Dornan*)

UNDERHILL, FRANK P. A Manual of Selected Biochemical Methods (*Chapman & Hall*) 17s. 6d.

WALKER, NORMAN. An Introduction to Dermatology. Seventh Edition (*W. Green & Son*) 21s.

WILSON, R. M. Clinical Method in the Study of Disease (*Oxford Medical Publications*) 5s.

Edinburgh Medical Journal

March 1922

EDITORIAL NOTES

Scottish Society of Anæsthetists.

At a Meeting of the Society, held in Glasgow on 26th November, *Dr J. Johnston*, the President, read his Inaugural Address upon the subject of "Some Pre-Anæsthetic Intoxications." The type of intoxication under discussion included the various drug habits, alcoholism being considered at some length as being fairly typical, and most likely to give trouble to the anæsthetist. The pathology was briefly outlined, and the most serious conditions, from the point of view of the anæsthetist, found to be acidosis, with nervous excitability and cardiac weakness. The possibilities of preliminary curative treatment were reviewed, particularly as to the reduction of acidosis, and the value of the judicious use of pre-operative hypnotics emphasised. The intractability of the alcoholic patient under general anæsthesia was found to be due mainly to defective oxygenation, and the chief dangers paralysis of the medullary centres and heart failure. The choice of anæsthetic was discussed, methods combining the administration of oxygen, with the various mixtures of ether and chloroform being preferred in most cases, the chloroform to be used as sparingly as possible. The danger of post-anæsthetic acidosis was noted and its prevention discussed. Variations from this type in the case of other drug habits, such as morphinism and cocainism, were mentioned, and the question raised as to the possibility of anæsthetic troubles due to the habitual use of such drugs as aspirin. The late effects of shell-gas poisoning as affecting the anæsthetist were also shortly reviewed.

Dr John Anderson, pathologist, Victoria Infirmary, Glasgow, submitted to the Society the clinical facts of the cases of death during the administration of anæsthetics which had taken place in Glasgow during the past thirteen years. Statistics of 417 cases were presented, showing the sex, age, and condition of the patient; the anæsthetic used, and time of administration; the surgical operation or disease for which the anæsthetic was administered, and the opinion as to the nature of death.

Appointments.

Sir H. Arthur Rose, D.S.O., has been appointed Chairman of the General Board of Control for Scotland, and Dr J. P. Sturrock has been appointed a Medical Commissioner.

Editorial Notes

Student's Expenditure.

In connection with the paper, "A Medical Student's Expenditure Seventy Years Ago," which appeared in our issue of November, a well-known practitioner writes—"I was a student in Edinburgh from 1853 to 1856. In May 1856 I went as an unqualified assistant in B——, at £30 a year and my board. I graduated in 1859. The total expenses of my medical studies, food, clothes, travel, and fees for M.D. and L.R.C.S.E. was £238, 1s. 8d."

The late Sir John Kirk.

The death of Sir John Kirk, G.C.M.G., K.C.B., M.D., F.R.S., in his ninetieth year, removes the last of the distinguished group of Edinburgh graduates who were the fellow-residents of Joseph Lister in the Royal Infirmary in 1855.

Born at Arbirlot in Forfarshire, Kirk studied medicine in Edinburgh and graduated M.D. in 1854. He saw service in the Crimea, and thereafter joined David Livingstone in exploring the Zambesi. His subsequent career was scientific and administrative rather than medical. As Consul-General at Zanzibar, as British Plenipotentiary at the Brussels Conference in 1889 to deal with African affairs, and as British Commissioner sent to inquire into disturbances at Brass, West Africa, in 1895, he rendered signal service to the native races, while upholding the interests of his own country.

Triple Qualification Passes.

The following candidates, having passed the Final Examination, were admitted L.R.C.P.E., L.R.C.S.E., L.R.F.P. & S.G.:—James B. Hendry, Ian F. M'Ash, Enid Ann Williams, Dominic Ciantar, Raymond Levey, Edward J. Allan, Samuel Sieff, Noel Kretzmar, Leonard E. Murray, Sidney Sack, William T. Davie, George M'Coull, Alexandra M. Limont, George H. Dobbin, James Readdie, John A. Nel, Alexander MacPherson, James H. Dobbin, Andrew M. Samarasinghe, Arthur S. Wickremesinghe, Jemima M. M'K. Calder, John R. Williams, Arthur R Lambie, Parmanand Madan, John R. M'Cubbing, Mohamed S. Hassen, Edward Spence, and James L. L. Jones.

Medico-Chirurgical Transactions.

The Discussion on Glycosuria arranged for the Meeting of the Medico-Chirurgical Society on Wednesday, 18th January, was unavoidably postponed till a later date. We hope to publish the contributions to the discussion in our April issue.

KERATODERMIA BLENORRHAGICA.*

By DAVID LEES, D.S.O., M.A., M.B., F.R.C.S.E.

THE cutaneous eruptions which follow on gonococcal infection were first mentioned by Pedoux in 1872, and may be divided into five main groups: (1) Gonococcal Ulcers; (2) Erethema; (3) Urticaria; (4) Hæmorrhage and Bullous Dermatitis; (5) Hyperkeratosis.

With the exception of the first group all are toxic manifestations, and occur only in very severe cases of infection, and often with an associated poly-arthritis. The most interesting, because the most distinctive toxic rash, is a hyper-keratosis, which is better known as Keratodermia Blenorrhagica.

Historical.—The condition was first accurately described in 1893 by Vidal,[1] and the first authentic case in Britain was reported in 1910 by Sequeira and Turnbull.[2] Forty-seven cases altogether have now been recorded, but the number would doubtless be considerably augmented if all cases of gonococcal arthritis were more closely examined. During the last five years eight cases have come under the author's observation, and in all of them, with one exception, there has been present, as in most of the published cases, an associated urethritis and arthritis, while in several of them other complications such as conjunctivitis, iritis, and endo-carditis co-existed.

Etiology and Pathology.—The condition may appear at any time during an attack of acute, sub-acute or chronic gonorrhœa. It may recur with successive attacks, and in one of Winkelreid Williams[3] reported cases, the skin condition appeared thirteen years after an attack of arthritis.

It is commoner in males than in females, and in the latter more so during pregnancy and the puerperium than in the non-gravid state. The youngest recorded case is by Roberts,[4] in a girl 4 years of age. Gonococci have only once been demonstrated in the cutaneous lesion, but they have frequently been grown in blood culture during an attack, thus suggesting a close association between the infecting organism and the cutaneous condition. Baermann[5] and Hierfordt[6] have pointed

* Read before the Medico-Chirurgical Society of Edinburgh, 1st June 1921.

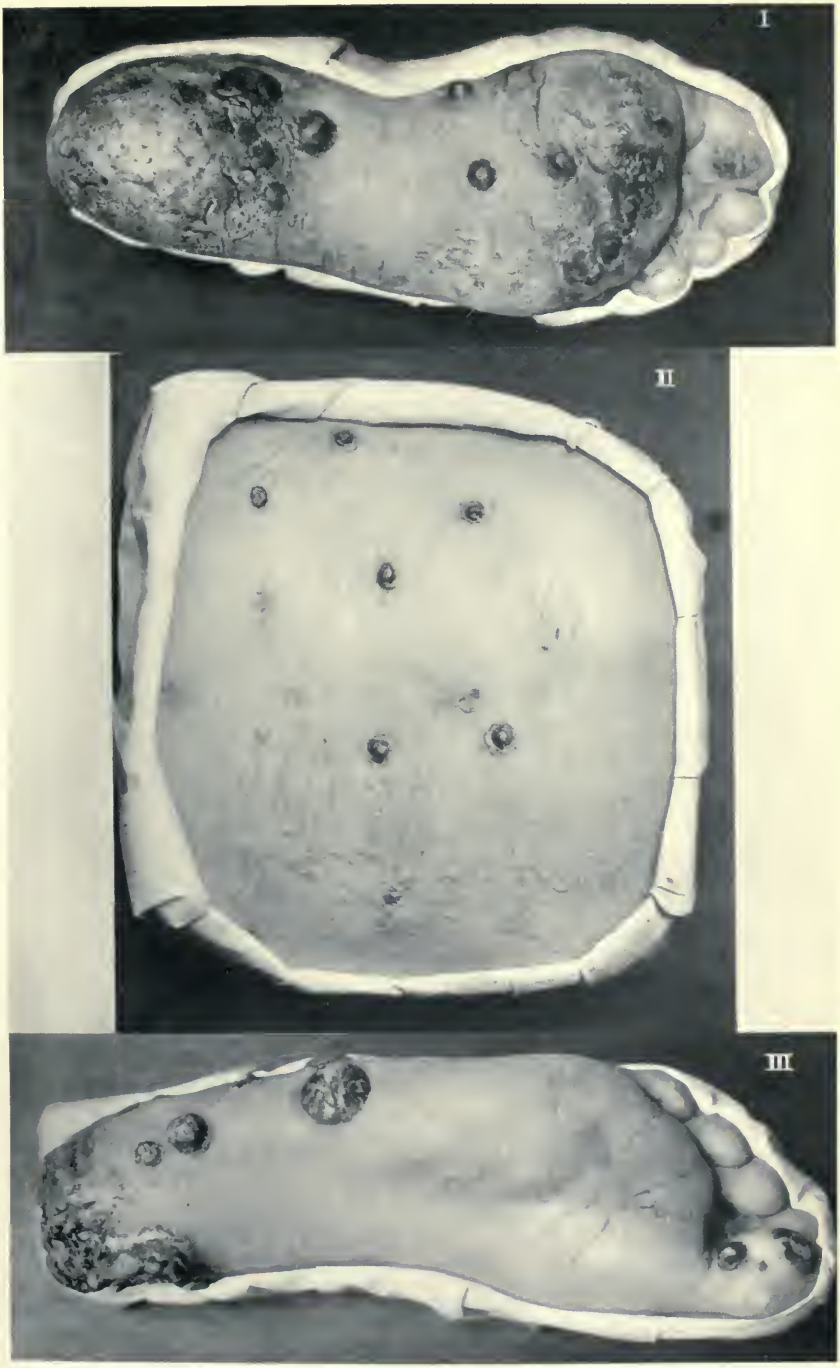
out that the skin condition wanes and waxes according as the urethral condition retrogresses or otherwise, although this is not so in the associated arthritis. Norris[7] suggests that the difficulty in demonstrating the organism in the skin lesions may be due to the fact that the skin is subject to changes of temperature, and is invested chiefly by squamous epithelium, and as such not a favourable habitat for the organism.

It is much more likely, however, that the lesion is a toxic local manifestation of the general systemic infection, and this view is supported by the frequent co-existence of other systemic lesions, by the almost constant accompanying cachexia, muscle wasting, and general anæmia. In the two cases under observation, and of which photographs and casts are shown, all these three conditions were present, and in one of them a poly-arthritis and conjunctivitis. The condition has been described as a pyodermia, and in each of the cases reported here a staphlococcus was isolated from the macerated tissue, and also from the serum from under the keratotic lesions, while in one of them in addition there was present a diphtheroid bacillus and an anaerobic spore-bearing bacillus.

Jacquet, Chauffard and Fiessinger[8] tried to inoculate animals and healthy individuals with the serum from underneath a keratotic crust, but failed. They could reproduce the lesion, however, in a keratotic patient if the skin were previously macerated by performing the inoculation under a watch glass. They thus concluded with Buschke[9] that the lesion was in the nature of a papillary dermatitis. French writers are inclined to think that the condition is a tropho-neurosis, and as patients with it usually suffer from hyperidrosis, this probably plays a large part in the causation of the horny excrescences.

M'Donagh[10] has found present in many cases a lymphocytosis of the cerebro-spinal fluid often as high as 17 per c.mm., and he is of opinion that it is due to meningeal irritation of the trophic fibres in the posterior nerve roots caused by the toxins of the gonococcus. This condition of Lymphocytosis was not present in either of the two cases shown.

Diagnosis.—The lesions are commonest on the feet and are primarily vesicles; they quickly become pustules, and finally the wall of the pustules becomes keratinised. When present on the prepuce and other moist areas keratinisation is not so marked. Balanitis circinata is a common association in male



I. Photograph of Cast of Foot of Case I. II. Photograph of Cast of Back of Case I.
III. Photograph of Cast of Foot of Case II.

patients. On the scrotum the macerated papules may closely resemble the moist papules of a generalised syphilis. The appearance on the extremities is, when the condition is developed, that of small conical protuberances of a dull pink colour. These protuberances soon become a dirty brownish yellow, are horny to the touch, and have surrounding their base a narrow pink areola seen clearly in the cast of the back (Fig. II.). The most apt description of the fully-developed lesion is that of the French authors who liken it to "mountain ranges on a relief map," or that of Sequeira who compares it to "sloes embedded in the skin." In the intervening areas the epidermis is parchment-like and thickened, and a dirty yellow, brown colour. At times the single lesions become confluent, and form an irregularly shaped horny mass of keratinised epithelium as seen in the heel in Fig. III.

Microscopically, there is a marked leucocytic infiltration of all the layers of the skin, especially of the dermis and epidermis. The condition is always symmetrical, and occurs chiefly on the balls of the great toe, the margins of the sole and the heel. The hands may be affected but less commonly, and only in severe cases the condition may be seen on the trunk and on the extremities. The nails and nail bed may be affected, and after great thickening may slough off in a complete cast. The onset is usually gradual, even in a case accompanying acute infection. There usually is an associated arthritis, while anæmia and muscle wasting are prominent features.

Prognosis.—Although the general blood infection is a severe one, the lesions react well to treatment. In some cases, however, there is a tendency to relapse, and recurrence with each fresh attack of gonococcal infection is not uncommon.

Treatment.—The first essential is treatment of the original infection of the genito-urinary tract. Little local treatment is required for the skin condition, and perhaps the most effective application is a lotion of equal parts of liquor arsenicalis and vin. ipecac. in spir. vin. rect. General hygienic treatment is essential. The value of vaccine treatment in combating the general toxæmia and in hastening the resolution of the skin condition is recorded in practically all the published cases. The exceptions are those of Montpelier [11]

and Lundie,[12] the latter mentioning a case in which the condition actually developed during the administration of vaccine.

In two cases which previously came under the author's observation in military hospitals during the War, vaccines and all other forms of treatment, both local and general, failed. Salvarsan, in small doses, was exhibited and the condition rapidly cleared up. In both of these cases the patients were extremely ill and emaciated, and made excellent recoveries under arsenic, although in neither was there any evidence clinically or serologically of syphilis.

Subsequent to treatment, it is noteworthy that in this condition, in spite of the severity of the skin lesion, no scarring is left, and the reddish brown pigmentation seen in the photographs quickly disappears.

The first case shown was treated with vaccines, the second with novarsenobillon in doses of 0·15 to 0·3 grams.

Case I.—Male, aged 22. Admitted to hospital 31st March 1921, with a history of infection seven weeks previously. Urethral discharge was of six weeks' duration, balanitis of fourteen days, and multiple arthritis of fourteen days' duration.

On admission a purulent urethral and sub-preputial discharge was present, the former of which contained gonococci. There was frequency of and pain on micturition. The urine contained pus in both first and second urine glasses. Balanitis circinata was typical. The prostate and both vesicles were enlarged and tender on palpation. Both knee and both ankle joints and the left shoulder joint were red, tense, and swollen. On the scrotum, the abdomen, and on the back there were scattered papulo-pustular lesions which resembled at first a commencing rupia, but which quickly became keratinised. On both feet there were a few papules of translucent appearance, which quickly assumed the horny character seen in the casts.

Syphilis was eliminated by three consecutive dark ground examinations of the serum from lesions, and by a "negative" Wassermann test repeated and confirmed later. The cerebro-spinal fluid showed no increase of cells, no excess of globulin, and the Wassermann test of it was "negative." The gonococcal complement fixation test was "positive." Cultures of the skin lesion showed staphylococci only. Liq. arsenicalis and vin. ipecac. in spir. vin. rect. was applied to the balanitis, which cleared up quickly in four to five days, and olive oil was applied locally to the feet and back.

In addition to local treatment of the urinary tract, vaccines in very large doses were administered at weekly intervals after initially desensitising the patient. When the urethral and prostatic condition became

sub-acute, massage of the prostate and vesicles was carried out at intervals of four days.

Both urethral and skin condition reacted quickly to treatment, and in five to six weeks all symptoms had cleared up in the urethra, in the prostate and vesicles, and in the joints and the skin, and the patient was able to leave hospital six weeks after admission, the skin condition showing a dark mottling, but no induration at the site of the keratotic lesions. All the gross signs and symptoms had then cleared up, and the patient, who is still attending hospital as an out-patient, now shows no sign of any previous gonococcal infection.

Case II.—Female, aged 63. Admitted to hospital 22nd March 1920, with a history of a condition which began on the palms of the hands six years previously, disappeared, and recurred on the feet four years later. At that time the hypertrophied tissue was removed with a sharp spoon but recurred two or three months later on the same area.

There was no definite history of a previous gonococcal infection obtained, but a history of frequency of micturition and subsequent joint trouble some 18 to 20 years previously.

On admission there was present some stiffness of both knee joints, but no gross arthritic lesion. The genital organs were atrophied, and there was no evidence clinically or serologically of a present or past syphilis. The cerebro-spinal fluid showed no increase of cells or excess of globulin and a "negative" Wassermann. Gonococcal complement fixation test of both blood and cerebro-spinal fluid was "negative."

On the ball of the large toe, on the heel, and along the outer aspect of both feet large horny growths were present, those on the heel having run together into a large keratotic mass. Several similar horny excrescences were present round the ankles and on the front of the legs. Staphylococci, dipheroids, and an anærobic spore bearing bacillus were isolated in culture from the horny growth.

Local treatment consisted in rest and in the application locally of a paint containing liq. arsenicalis, vin. ipecac. and spir. vin. rect. General treatment consisted of tonics and the administration of small doses of novarsenobillon from 0.15 to 0.3 grammes, and under this the horny masses disappeared in about two months but recurred three months later, and this time with more typical keratotic appearance. The condition cleared up completely again after six weekly doses of novarsenobillon.

I have heard from this patient that the condition has again recurred, though to a much less extent, after being absent for six months; and it is proposed to give a course of gonococcal vaccine to this patient during the next few weeks to test the effect of its administration in a case where arsenic has failed to more than temporarily clear up the clinical signs.

REFERENCES.—[1] Vidal, E., *Annales de Dermatologie et de Syphilographie*, 1893, p. 3. [2] Sequeira, J. H., and Turnbull, *Brit. Jour. Dermat.*, 1910, vol. xxii., p. 139. [3] Williams, A. W., *Proceedings Roy. Soc. Med., London*, 1911, vol. iv., part i., p. 12; also *Brit. Jour. Dermat.*, 1910, vol. xxii., pp. 361 and 369; also *Brit. Med. Journal*, 1914, vol. ii., p. 627. [4] Robert, *These de Paris*, Ap. 28, 1897. [5] Baermann, G., *Arch. f. Dermat. u. Syph.*, 1904, vol. xix., p. 363. [6] Heerfordt, *Arch. f. Dermat. u. Syph.*, May 1911, p. 361. [7] Norris, *Gonorrhœa in Women*, 1913, p. 443. [8] Chauffard and Fiessinger, *Bull. de la Soc. Fran. de Dermat. et de Syph.*, May 1909, p. 162; also *Ikonographia Dermatologica*, 1910. [9] Buschke, A., *Arch. f. Dermat. u. Syph.*, Vienna and Leipzig, 1899, vol. xlviii., p. 181. [10] M'Donagh, *Venereal Diseases: Their Clinical Aspect and Treatment*, p. 335. [11] Montpelier, *Les Annales des Maladies Veneriennes*, May 1918. [12] Lundie, *Brit. Jour. of Surg.*, vol. v., No. 19, Jan. 1918, p. 389.

CLINICAL RECORDS

A CASE OF MENINGEAL NÆVUS

Associated with Adenoma Sebaceum.

By DAVID M. GREIG, C.M., F.R.C.S.E., Conservator, Royal College of Surgeons' Museum, Edinburgh.

Emboldened by the report of a case by Campbell and Ballance,[1] I place on record the following instance of a vascular meningeal tumour, perhaps more correctly to be termed cerebro-meningeal, associated with right hemiplegia, epileptiform convulsions, and that peculiar skin affection known as "adenoma sebaceum." I do so all the more readily, as operative interference produced an unexpected amelioration during nine years.

John E——, a male, aged 18 years, the subject of "fits" during fifteen years and of paralysis of the right side during eleven years, was transferred to my men's ward in the Dundee Royal Infirmary in February 1913 by Dr J. Mackie Whyte, under whose supervision he had been for ten days.

History.—His parents were well, but the father, a man of alcoholic habits, resided apart from the family. He was the elder of two; his sister, aged 16, was said to have "a weak chest." During the third month of his intra-uterine life, his mother had been thrown into a nervous and excited state, the cause, she alleged, being "a drunken husband." The birth, however, was a natural one, no instruments being required. The umbilical cord was said to have been found twisted four times round his neck.

When 2 weeks old he had, according to his mother, retention of urine, for which he was "pierced four times" (catheterised?) At the age of 14 months—during teething—he had convulsions, and the gums were "lanced." He was late both in sitting up and in walking, and, under the belief that he had "a weak back," he was frequently bathed in a solution of rock-salt. He did not walk, however, until he had completed his fourth year. When about 3 years old he took "fainting turns," which gradually assumed periodicity, until they occurred regularly morning and evening; and in the course of time they developed into "something more like a fit." No clear description of these "fits" could be obtained, but there seems little doubt that about this time he manifested some weakness of the right side.

He went to school at the age of 7 and attended "off and on" until 14 years old. During that time the "fits" came on as usual, night and

morning, but he had none during the day. His hemiplegia, however, slowly increased. He had whooping-cough, and, later on, during an epidemic, smallpox of a mild type, for he had been vaccinated in infancy. Until the age of 10 he had one "fit" each night, but during the subsequent five years they increased to four or five nightly. At school he was said to be "clever in a sense," and to do "very well" in some subjects (unspecified), and he reached the fourth standard of the educational code.

Six months before admission he had a very severe "fit" one night, and after that, the "fits" were more prolonged, stronger, and more frequent, and he lost weight and strength. Three weeks before admission his symptoms again underwent exacerbation, he became unable to stand, even with assistance, and his "fits" followed each other in rapid succession night and day.

The eruption on his face had been noticed *at* birth.

Condition on Admission.—He looked older than his years, was thin and poorly developed, but moderately well nourished. His face, which was pale, presented a papular, nævoid eruption over the middle third of the nose. The rash extended on to the cheeks, and involved from the naso-labial folds to the malars, with a symmetrical distribution like an acne roseacea. It was composed of numerous small papules, more or less acuminate and closely set together. Few papules were larger than a millet-seed; some were pink or brownish-red, and some were skin-coloured; but most presented in some degree, on or about them, a capillary telangiectasis. A few papules, similar but discrete, appeared on the chin and upper part of the neck.

His heart and lungs appeared normal, but there was deficiency in movement of the muscles on the right side of the chest and abdomen. In no "fit" had he ever bitten his tongue, nor had he ever had incontinence of urine or fæces.

The pupils were equal and reacted normally to light and accommodation, and the ocular fundi presented no abnormality, even after a "fit." There was no difficulty in deglutition, and his appetite was fair. Since his illness had become worse his bowels had become constipated. He had no trouble with micturition.

All tendon and cutaneous reflexes were elicited except the plantar, and the patellar reflex was exaggerated on the paralysed side. He could neither raise his right foot off the bed nor approximate it to the buttock, and he was not able to sit up without assistance. Between "fits" he lay restfully, and expressed himself as being comfortable. Fairly intelligent, he answered questions correctly, if somewhat slowly.

The Fit.—Each "fit" lasted from one to two minutes. What he called "a queer feeling" constituted the aura, and was invariably present. When he felt the "fit" coming on he grasped his right hand

with his left to prevent the right arm from being carried involuntarily above his head. Twitching commenced in the right ring finger, and, in anticipation of what was to follow, he seemed to stiffen and stretch himself out. Trembling clonic movements rapidly involved the whole upper extremity and spread down the right side to the lower extremity. At the same time the head was turned to the right, the mouth was opened, and the eyes were staring. Consciousness was not lost. Towards the end of the "fit" the movements became more individual, coarser, and slower. The twitching always began in the upper extremity, and as a rule passed off in the reverse order, but on very rare occasions the twitching had continued in the lower, after it had ceased in the upper, limb. The face was not exempt from spasm, and though both sides might be affected, it was invariably more active on the right. He sometimes had pain in the right shoulder and right leg during a "fit," and not unfrequently complained of pain in the right leg *after* the "fit," though the spasms in the leg never appeared to be so severe as those in the arm.

The Operation.—Chloroform alone was used during the operation, and the patient took the anæsthetic well. No twitching occurred during anæsthesia, and the breathing remained even and regular throughout. A large osteoplastic flap was turned down to expose the left cortical motor area. The mesial saw-cut, though well clear of the sagittal sinus, started a considerable venous oozing, and had to be temporarily plugged with gauze until the completion of the other saw-lines. On raising the bone the oozing was seen to be coming from under the dura through a small saw-wound, and though it obscured the dura somewhat, that membrane seemed unusually dark. The middle meningeal artery was divided between ligatures and the dura opened and reflected. The Rolandic area was then seen to be covered by an enormous number of large veins, forming a vascular tumour, which projected into the upper part of the opening, and extended to the great longitudinal fissure. It was obvious that removal of this would be impossible, on account of its cerebral connexions, and so the whole area was gone round with catgut on an aneurism needle, and every vessel that could be under-threaded was ligatured. The dura was drawn together by catgut sutures, but the bone was not replaced. To what extent, if any, enlarged vessels extended into the brain-substance could not of course be made out, but at the end of the ligaturing the nævus seemed considerably smaller. Shock and loss of blood alone, however, might have accounted for this.

Course of Convalescence, and Subsequent History.—On his return to the ward from the operation theatre it was noticed that his right pupil was twice as large as his left. He was pale and somewhat restless, but recovered quickly from the anæsthetic, and only

vomited in two occasions, namely, four and seven hours after the operation. He had been in bed two hours when he had "a sort of a fit," which was different from any he had had before, in that it affected the whole body with a trembling, but there were no definite clonic spasms. (In this connection it is to be remembered, that not unfrequently a pseudo-rigor occurs when the effect of an anæsthetic is beginning to pass off.) A quarter of an hour later, and again two hours after that, he had a slight trembling confined to the right side of the body. The head was not retracted nor turned, and there was no deviation of the eyes.

During the next two days, and on three subsequent occasions, a little twitching of the right hand and fingers was noticed, but there was no "fit." The adenoma sebaceum was less distinct, but that might have been due to anæmia resulting from the hæmorrhage during the operation. A fortnight after the operation, he was well. The muscles of the right forearm were softer than those of the left. On attempting to straighten the fingers a *main en griffe* was observable. He was able to raise his hand above his head, though a degree of unsteadiness with tremor accompanied retention in that position. The grasp of the right hand was only half as powerful as of the left. Though he could flex and extend at the elbow, the power was much below normal. Similar improvements had occurred in the lower extremity. He was able to raise his foot off the bed, and could flex and extend the thigh and leg, though tremulousness accompanied any movement that was a strain. There was a suggestion of deficient movement of the lower part of the face on the right side. His reflexes were present and appeared normal. Localisation of stimuli was a little less accurate on the right than on the left side. He could walk with a little assistance, and took his food well.

During the succeeding years he continued in fair health, and had no recurrence of his "fits." He was unable to obtain employment on account of his hemiplegia, which, of course, only improved and did not pass off; but he remained at home, able to take charge of matters there, and do the house-work, while his mother and sister went out daily to work. Early in 1921 he began to act strangely, such as turning on the gas in the day-time, putting things in their wrong places, etc. His memory was evidently defective, he did not realise he was in error, and he became irritable, and if found fault with would break out into violent tempers. About October he had to be removed to the observation wards of the city hospital, and there seems a probability he will be transferred thence to an institution for the insane.

Remarks on the Intracranial Condition.—Like hæmangiomata elsewhere, the condition was congenital and the

108 L

John E——, aged 18 years, showing Adenoma Sebaceum. A distinct depression of the scalp indicates the site of the Craniotomy for Meningeal Nævus.

growth liable to increase in size. That it did so cannot be doubted, though it did not produce recognisable results until 3 years of age. The consolidation of the skull on closure of the fontanelles, would alone tend to hasten or exacerbate irritative symptoms; while the normal increase of the brain in bulk, which continues till about 19 years of age, would act in the same direction. How far the veins, passing from the angioma into the cerebral cortex, had participated in the increase in size it was not possible to say; but, on the likelihood of their being considerably affected, one was prepared for a post-operative amelioration, less immediate, less complete, and less prolonged than actually ensued. Knowing from experience the imperfect result which is apt to follow ligature, and generally follows incomplete excision, of nævi in other parts of the body, the result was surprisingly satisfactory.

The focal nature of the epileptiform convulsions, with the retention of consciousness, were the points, to my recollection, which influenced Dr Mackie Whyte in advising operation. The duration of the affection and its insidious progression seemed to negative the usual causes of focal epilepsy; and it was not until the skull was opened that the nature of the irritation became evident. The complete relief from convulsive attacks which had lasted fifteen years, and the regain of strength in the affected limbs, were all that could be expected, because degeneration of cerebral tissue must have taken place. Even following the operation one would have expected a degree of sclerosis, and with the increase and hardening of the neuroglia, degeneration of the essential cerebral cells and of the entire neurones. It is probably an extension of such a process that, eight years later, impaired his mental faculties. Doubtless his life has been prolonged during nine years, and through eight of these he had been able satisfactorily to fulfil useful, if subservient, filial duties.

Remarks on the Adenoma Sebaceum. — This striking cutaneous condition was not present in Campbell and Ballance's patient. Nevertheless it is interesting, in that it was, as usual, a congenital condition in association with a minor degree of mental deficiency and with epileptiform convulsions. If the primary pathological change in adenoma sebaceum be a vascular one, then it is particularly suggestive that a cutaneous telangiectasis should accompany a meningeal venous angiectasis. But, though to the ordinary observer, the telangiectasis in

adenonia sebaceum seems quite definite, dermatologists are not at one on the point. Sequeira[2] divides adenoma sebaceum into, where lesions are pale (Balzer), where tumours are pink (Pringle), and where the surface is warty (Hallopeau and Leredde). But are these manifestations not different degrees of the reaction of growing tissues under the influence of increased blood supply? Pringle insists on the increase in the glandular element, but apparently such is not present in all cases. On the other hand, Norman Walker[3] writes: "Many cases . . . have certainly been lymphangiomata." Stelwagon[4] modifies Crocker's suggestion,[5] and choosing a pathological basis of nomenclature, proposes "pilosebaceous hydradenoma."[9] It may be called to mind that a very similar result in overgrowth of tissues may result from their being bathed to excess in lymph as in blood, as is noticeable in many cases of acquired,[6] and in most, if not all, cases of congenital, œdema.[7] Overgrowth may be more complete and more excessive with a hæmangioma, but it may also be quite evident with a lymphangioma, and acknowledgment of such degrees might clear up dermatological differences on this point.

There is common agreement, however, that adenoma sebaceum is far more common among congenital mental defectives than among normal people, or than among the insane or the mentally affected other than congenital. It is also generally admitted that adenoma sebaceum is, in a very large proportion of cases, associated with convulsions or epilepsy. In a very interesting paper on tuberous sclerosis, Fowler and Dickson[8] give a table of twenty-nine cases of this disease, all patients were mentally defective, and thirteen of them are noted as having adenoma sebaceum present; and in *all* the thirteen, epilepsy or convulsions was, or had been, a feature. In respect of tuberous sclerosis it is significant, that in the literature of adenoma sebaceum, the co-existence of fibromata is frequently mentioned, sclerosed portions in the brain in the former, sclerosed portions in the skin in the latter, both structures with a community of blastocytic origin. Nor can the association fail to remind one of the nervous origin of neurofibromatosis.

So extremely common is it that adenoma sebaceum is congenital and present at birth, that any statement of its late appearance should be accepted only after the fullest investigation. It must be remembered, too, that all epileptics are not,

in the ordinary acceptation of the term, mental defectives; and in persons, the subject of adenoma sebaceum who are reported free from epilepsy, the existence of convulsions or fits, nocturnal and therefore unrecognised, or present in earlier life, must be duly considered and thoroughly sought for. The only other cases of adenoma sebaceum which I, personally, have met with occurred in two children, both mentally deficient, both epileptic, and in both it was congenital and present at birth.

REFERENCES.—[1] Campbell, H., and Ballance, Sir C., "A Case of Venous Angioma of the Cerebral Cortex," *Lancet*, 7th January 1922, p. 10. [2] Sequeira, J. H., *Diseases of the Skin*, 3rd ed., p. 43, London, 1919. [3] Walker, N., "*An Introduction to Dermatology*, 6th ed., p. 336, Edinburgh, 1916. [4] Stelwagon, H. W., *Diseases of the Skin*, 8th ed., p. 686, Philadelphia, 1919. [5] Crocker, H. R., *Diseases of the Skin*, vol. ii. p. 922, London, 1903. [6] Greig, D. M., "A Case of Progressive Subcutaneous Œdema, *Edin. Med. Journ.*, September 1916. [7] Greig, D. M., "Congenital Œdema," *Edin. Med. Journ.*, April 1919. [8] Fowler, J. S., and Dickson, W. E. C., "Tuberous (tuberose) Sclerosis," *Quart. Journ. Med.*, vol. iv. p. 43, Oxford, 1910-11. [9] *Cf.* "Un cas d'hidradénomes éruptifs," R. Brunier et Bloch, *Bull. Derm. et Syph.*, No. 8, p. 404, Paris, 1921.

TORSION OF APPENDIX EPIPLOICA SIMULATING ACUTE APPENDICITIS.

By J. N. J. HARTLEY, M.B., F.R.C.S.

THOUGH undoubtedly more common than literature would indicate, torsion of an appendix epiploica, giving rise to acute symptoms, is probably sufficiently rare to render the following case of interest.

Miss C. E., aged 35, was admitted as an emergency case to Ward 7 of the Edinburgh Royal Infirmary. Two days previously, while on holiday, she began to have pain in the right lower quadrant of the abdomen. The pain was first noticed after a mid-day meal, and was described as a steady, gnawing pain, rendered worse when she stooped or mounted stairs. Tenderness was also noticed by the patient in the same region. During the forty-eight hours prior to admission the pain persisted and grew steadily worse; there was no vomiting.

For ten months previously occasional attacks of slight pain in the right lower quadrant had been noticed, but the attacks were trivial and evanescent; otherwise the patient had had perfect health.

On admission, the patient was found to be a well-nourished woman.

Though pain was complained of, there was no marked distress. Temperature, 99° F., and pulse 88.

The abdomen was well covered with fat. Apart from slight restriction of movement in the lower quadrants, there was nothing abnormal to note on inspection. Marked tenderness was elicited over the right rectus muscle, especially just to the right of the umbilicus, and the muscle was definitely rigid. Nothing abnormal was found in the urine.

A provisional diagnosis of acute appendicitis was made, and an operation performed forthwith.

Operation (Sir Harold J. Stiles).—The abdomen was opened through a right oblique incision, the various muscle layers being split in the direction of their fibres. A mobile cæcum was readily brought out, and the vermiform appendix examined. The latter appeared to be perfectly healthy. Several appendices epiploicæ, containing a large amount of fat were present on the cæcum, and a few even on the terminal part of the ileum.

Thus far nothing had been found to account for the patient's symptoms. Further examination, however, revealed the presence of a dark, purple-covered appendix epiploica, attached by a narrow pedicle to the anterior surface of the ascending colon, some distance above the ileo-cæcal junction. The appendix epiploica was discoid in shape, heavily laden with fat, and its delicate pedicle was twisted fully twice. Its base was ligated, and the appendix epiploica removed. The vermiform appendix, though normal, was likewise removed, and the abdomen closed.

The patient made a speedy recovery, and since has been quite free from pain.

V. C. Hunt[1] has recently reviewed the literature on torsion of appendices epiploicæ, and has reported a series of cases from Mayo's Clinic. In all, 26 cases of true torsion of an appendix epiploica are referred to, and of these 10 occurred within a hernial sac. Those that occurred within the abdomen were in a few cases symptomless; but, in the majority, there were more or less acute symptoms which led to the diagnosis of "appendicitis," "gallstone colic," "intestinal obstruction" and "diverticulitis of the pelvic colon." The appendices most frequently involved were those of the sigmoid. The pathological changes varied greatly. In some, there were venous engorgement and petechial hæmorrhages; in others, fat necrosis with cyst formation or actual gangrene; and in others, fibrosis and calcareous degeneration. A series of cases are likewise referred to in which loose bodies in the peritoneal cavity probably

resulted from the torsion and sloughing off of appendices epiploicæ.

Though an appendix epiploica may be infected by the spread of micro-organisms from a diverticulum, Hunt could find no evidence of it in any of the cases with torsion of the pedicle. To exclude the possibility of a diverticulum being present in the case here detailed, the pedicle was sectioned and examined microscopically.

With regard to the causation of torsion, Payr's theory of the difference of length of artery and vein is suggestive. In congestion, particularly when the veins are engorged as a result of stasis, the difference of length has been thought to be a possible cause of the twisting of the pedicle. To investigate this, the specimen was rendered transparent by means of benzyl benzoate and methyl salicylate. The extravasated blood throughout the appendix was prettily demonstrated, but the appearance of the vessels was not that of an engorged vein being spirally wound around a taut artery.

The prime etiological factors in the case here reported were probably the discoid shape of the appendix epiploica, the narrowness of its pedicle, and the mobility of the cæcum and ascending colon.

REFERENCE.—[1] V. C. Hunt, *Annals of Surgery*, January 1919.

CRITICAL REVIEWS

RECENT CONCEPTIONS OF STOMACH PHYSIOLOGY AND THE GENESIS OF GASTRIC PAIN

By ROBERT MAILER, M.B., Ch.B., F.R.C.S. Ed.

It is almost a century since Beaumont performed his famous experiments that laid the foundation of modern gastric physiology. Following his lead, the subject engaged the attention of some of the most gifted observers of the day, without much real progress being made until the discovery and application of the Röntgen ray brought a welcome fillip to this realm of experimental medicine, so important, and yet so imperfectly understood. The pioneer work of Hurst, Cannon, and Pawlow has stood the challenge of years. It has been amplified, but never controverted.

In the following short survey an endeavour has been made to indicate the lines along which research is being carried out at the present day, and incidentally to emphasise the problems that still remain only partially solved.

Motor Functions of the Stomach.—The peristaltic contractions, which are the distinctive feature of stomach movement, start in the region of the cardia, and sweep in successive cross sections towards the pylorus where they terminate, increasing in amplitude till they reach a maximum in the antrum. Though Cannon[1] described these contractions as commencing about the middle of the body of the stomach, it is now accepted that their origin is near the cardia, but they are not strong enough to show with the Röntgen rays until they have reached the former situation. Secondly, the stomach is in a condition of tonus, and the peristaltic contractions and tonus are subject to certain influences such as the general health of the individual, the contents of the stomach, the presence or absence of irritable foci, the quality and quantity of the blood supply and stimuli from the vagus and splanchnic nerves.

Recently Brinton's old theory of the three gastric streams—one along the greater curvature, one along the lesser curvature, and a reversed medial current—has been given added significance by the observation of the return of solid particles from the antrum to the body of the stomach, and by the researches of Jefferson[2] and Moritz[3] in respect to the existence of a gastric stream which follows the lesser curvature. Keith, Wood Jones,[4] and Lewis[5] have shown that there is an epithelial passage along the lesser curvature of the fœtal stomach such as could convey fluids to the pyloric portion.

This is called the canalis gastricus, and many writers have brought forward evidence that the canal persists in the human adult, Jefferson's observations with fluid suspension of bismuth being particularly suggestive.

More recently Alvarez[6] has shown that the stomach is graded in irritability, latent period, and rhythmicity, from cardia to pylorus, and that the most highly conductile tissue lies as a strip along the lesser curvature. The resemblance to the mechanism found in the heart is therefore very close, the differences being explainable by the fact that the organs are modified to fulfil very different functions.

Much research has been carried out in the endeavour to identify in the region of the cardia specialised nodal tissue similar to what is found in the heart and which acts as a pace-making mechanism. The lack of uniformity in the findings warrants the assertion that up to the present time no such nodal tissue has been proved to exist.[7]

It has been shown, however, that the rate of metabolism varies at different parts of the stomach, and that in fact there is a definite gradation in the metabolic rate from the cardia to the pylorus.[8]

This metabolic gradient probably underlies the normal downward gradients of rhythmicity and latent period, and it becomes reversed in sick animals such as distempered dogs. It is conceivable that an ulcer near the pylorus may raise the metabolic rate in the surrounding muscle above that in the cardia, and give rise to the reversed peristalsis which is seen sometimes with the Röntgen rays.

The metabolic rate in the duodenum, on the other hand, is high compared with that of the pylorus, and this may account for the infrequency with which carcinoma originates in the duodenum, or spreads to it across the pyloric line, as the mucous membrane of the duodenum is kept young by its high rate of metabolism.[8]

Again the waves of contraction have to pass along the greater curvature more rapidly than those along the lesser curvature so as to reach the pylorus synchronously and produce co-ordination. This may be interfered with as a result of ulcer on the lesser curvature which blocks the advancing waves so that they meet not at the pylorus but beyond it.

It seems likely that a similar result would be brought about by any operation which shortens the lesser curvature, and may explain why a better functional result follows a sleeve or segmental resection of the stomach than a V or triangular resection—a point especially emphasised by Mayo and Moynihan and borne out by the experimental observations of Stewart and Barber.[9]

Nervous Control of the Stomach.—The nerves of the stomach are derived from the vagus and the sympathetic, and contain medullated and non-medullated fibres. The nerves from the gastric

plexus to the stomach are also distributed to the upper level of the duodenum. The right vagus, which is the most important, supplies fibres to the posterior wall of the stomach, the solar plexus, the spleen, the pancreas, the intestine, and the mid-colon, and it anastomoses with the left vagus. The vagus supplies motor fibres to the whole musculature of the stomach, and furthermore, the latter has connections with the gall bladder and the appendix through the solar plexus.

The sympathetic fibres, on the other hand, are mainly inhibitory, the exception being that some of those supplied to the pyloric sphincter are motor. It was first shown by Cannon[10] that the motor function of the stomach is not fundamentally affected by the division of the vagus and the splanchnics, but the influence of these nerves upon the automatic activity of the stomach has been amply demonstrated by Bayliss[11] and others.

Again the stomach is the spokesman for many diseases located elsewhere more or less remotely in the alimentary canal. In response to these stimuli, the tone of the cardia or the pylorus may change, giving rise to a cardiospasm or a pylorospasm, or the change in tone may be more widespread, involving the body of the stomach or the body and sphincters combined, and giving rise to a gastrospasm or even a true gastric tetany.

The Control of the Pylorus.—The actual mechanism of the action of the pylorus has been the subject of some controversy. The earliest anatomists and physiologists considered that the pylorus was endowed with a kind of intelligence that enabled it to select what was proper to pass through, while it rejected the remainder. The more rational explanations which followed were essentially mechanical in nature, but not entirely satisfactory.

Cannon[12] suggested that the pylorus was under the chemical control of the acid chyme, and the wealth of experimental evidence in support of this theory led early to its acceptance by clinicians and physiologists, and at the present day its general correctness is not doubted.

Cannon himself, however, realised the shortcomings of his theory, for it failed to explain the emptying of the stomach in achylia, or the rapid exit of water and neutral egg-white solution, which leaves the stomach before the free acidity of the gastric contents is present to effect an opening of the pylorus, or sufficiently concentrated after ejection into the duodenum to effect its closure. Moreover, several observers have noted that 1 per cent. sodium bicarbonate solution hastens discharge from the stomach.[13]

More recently Cole[14] found that food started to leave the stomach immediately after it was ingested, and that the pylorus opened partly at each "gastric systole" and closed during "gastric diastole." In

short, he correlated the opening of the pylorus with the passage of peristaltic waves and an increased tonicity of the stomach.

His observations have been abundantly confirmed by Carlson [15] and others, and there seems no doubt that in the earlier stages of digestion, before the free acid has risen sufficiently in concentration to take over charge of the pylorus, peristaltic waves when they reach the antrum cause an inhibition of the pyloric sphincter, and the mechanism is simply another application of the Bayliss and Starling law which states that a contraction wave occurring in one part of the alimentary tract is associated with a relaxation of the part immediately below.

It is thus seen that the above law while originally meant to refer only to intestinal movement, is capable of a wider application.

Gastric Analysis.—It is many years since gastric analysis became an indispensable feature of medical practice.

As a clinical method it has largely been overshadowed in recent years by Röntgen ray examination, which from a practical standpoint has been found to give more rapid and accurate information as to the functional power of the stomach.

The technique of gastric analysis has progressed rather more rapidly than has the understanding of the physiological functions on which the practice is based, and in consequence of many of the problems relating to secretion and absorption remaining unsolved, we were in danger of our clinical tests getting too far in advance of our powers of interpretation.

The discovery of secretion-producing hormones or secretagogues has paved the way to a clearer understanding of long-known facts. Even before the experiments of Pawlow, it was known that water is a gastric stimulant, and it seems likely that water washes gastric hormones into the intestine where they are absorbed and act on the secreting glands through the blood, for the existence of a gastrin or true chemical stimulant can no longer be doubted. Moreover, gastrin bodies have been shown to be present in the liver, pancreas, and thyreoid, as well as in the gastric mucosa.[16]

The routine method of gastric analysis for clinical purposes has been to give the patient an Ewald test meal and to draw off the stomach contents by means of a rubber tube one hour later. By measuring the volume of the contents withdrawn, we assume that we know the amount of meal and secretion remaining in the stomach. By titration we learn the concentration of acid present.

The objections to this method are that we may not obtain all the contents of the stomach, and that our findings represent only one phase of digestion. Now gastric digestion is marked by a series of constantly changing phases, so that an examination of any single

phase of the digestive curve gives no information as to what has preceded or what will follow that phase. Marked changes occur in very short intervals so that findings at one period may be doubled or trebled at another. To get over these difficulties, the fractional method of examination of the stomach contents was introduced and first practised by Ehrenreich in 1912.[17]

In this method of examination as now modified by Einhorn and Rehfuss, a special stomach tube is used. It consists of a hollow steel tip, bulbous in shape, and perforated or slotted, and linked to a length of No. 8 French tubing. The weight and shape of the tip enable the tube to be readily swallowed, and to be passed into the duodenum if required. It is capable of being left in the stomach for long periods, and samples of the contents of the stomach can be withdrawn at intervals of fifteen or thirty minutes. Used in conjunction with the Ewald test meal, it affords a method of making a fractional study of the gastric juice over the whole period of digestion.

Fractional examination may be combined with barium meal and Röntgen ray examination.

By this fractional method of examination it has been shown that gastric digestion comprises a series of phases. There is firstly, the response to food entering the stomach—the digestive phase; and secondly, long or short pauses comprising the interdigestive phase.

The digestive phase is characterised by a relaxation of the tonus of the stomach, the inauguration of peristalsis, and a change to a much higher acidity, the total acidity averaging 70.

The interdigestive phase is the resting period of the gastric cycle, and is characterised by an approximation of the gastric walls and relaxation of the pylorus, allowing of regurgitation of the alkaline secretions of the liver and pancreas from the duodenum.

The secretion of acid is slower, because psychic stimulus and chemical secretagogues are wanting, and the acidity, which never rises above 30 during this stage, is maintained at its low level by the tryptic regurgitation from the duodenum.[18]

It is seen then that even during the resting period the stomach is never empty and never inactive, and the mild contractions which pass over it at this time give rise to the subjective sensation of hunger pangs.

Using this fractional method of gastric analysis on large numbers of healthy normal individuals, Rehfuss[19] made some very interesting observations.

He found that the gastric response to a given meal varies widely in different individuals. By determining the acidity of the contents at short intervals, and plotting a curve of the results obtained, he found that there is no normal secretory curve. In some individuals

the maximum acidity was reached very early, in others late; some stomachs emptied quickly, others slowly, and furthermore the total acidity was almost invariably higher than we have been in the habit of associating with the normal.

Again comparing the acid curves in normal individuals fed on various foodstuffs, and in those suffering from ulcer (afterwards verified by operation), he found that in 45 per cent. of the healthy cases the total acidity exceeded 100, and the same figures were obtained in 42 per cent. of the ulcer series. There was no greater incidence of high acid figures in ulcer or in other gastric disease than in health. These findings are in accordance with the observations of Hardt[20] and others, and should they receive further confirmation, it is obvious that our present views with regard to hyperacidity will require to be reconsidered.

The main difficulty all along has been the question of a normal standard for comparison. The limits of normal and pathological gastric function have never been clearly defined, and until we have a more accurate conception of the possible variations of the stomach in health, we cannot expect the fullest assistance from gastric analysis in the interpretation of disease.

Lastly, it should be stated that the fractional method of gastric analysis has not found much favour as a diagnostic routine among clinicians in this country. While acknowledging the undoubted possibilities of the method, they are chary of introducing it into everyday medical practice in view of the difficulties and discomfort attending its use.

Gastric Pain.—The finding of high stomach acidities in normal individuals raises the question of the relationship of acid to the pain associated with peptic ulcer of the stomach. The painful feeling awakened by contact of an irritant-like acid with an abraded surface-like skin or mucous membrane is sufficiently familiar in everyday experience to have suggested the view that the pains of gastric or duodenal ulcer are associated with acid irritation of hyperexcitable nerve endings or exposed nerve fibres in the ulcer area. This is the most widely current view of the genesis of gastric pain. In harmony with this theory is the frequent occurrence of so-called hyperacidity in gastric ulcer, and the temporary alleviation of the ulcer pain by food and alkalis.

Against this acid corrosion theory may be placed the following facts:—(1) The pain of gastric ulcer may be present and be temporarily relieved by food and by alkalis, even though the stomach contents are alkaline. (2) The introduction of HCl does not induce or augment ulcer pains. (The evidence on this point, however, is

conflicting.) (3) Ulcer pains are gnawing or boring in character, and show a distinct periodicity, the periods being too short to be explained by periodic changes in the gastric acidity.[21]

Has the Stomach Pain Nerves?—There is still considerable confusion regarding visceral pain in general and gastric pain in particular. Lennander[22] concluded that only the parietal peritoneum is sensitive to pain, and that visceral pain is due to stimulation of the parietal peritoneum by pressure, inflammation, or traction on the mesentery.

Lennander's observations were based on a large number of laparotomies performed under local infiltration anæsthesia with cocaine. One fallacy in the foregoing was pointed out by Meltzer,[23] who was able to demonstrate in the case of animals, that the normal gastro-intestinal canal possesses the sensation of pain, but that this sensitiveness disappears when a small amount of cocaine is injected into the tissues of the abdominal wall or elsewhere. He inferred from these experiments that cocaine abolishes all visceral sensation by absorption through the circulation. In short, it acts as a general anæsthetic as well as a local.

Meltzer maintained, therefore, that there is actual visceral sensation, and that the sensitivity of the inflamed organ is still greater. These results are confirmed by Ritter.[24]

Mackenzie believes that the viscera are entirely insensitive, and that the pain from the stomach is always referred to the skin segments, a viscero-sensory reflex.

Head, on the other hand, believes that the viscera are endowed with a low degree of sensibility, which, according to Langley,[25] is dependent upon the smaller number of nerves supplied to the viscera as compared with the skin.

On the whole the evidence is in favour of the stomach possessing pain nerves.

The Relation of Acidity to Pain.—In the normal stomach the injection of weak acids causes no pain.

In the case of ulcer, Hurst[27] reports that in six cases confirmed by operation, 4 ounces of 0.5 per cent. HCl produced no sensation even when pepsin was added. Similar results have been obtained by other observers.

Hyperacidity symptoms may be present with normal acid values, and even in achylia.[28] Bolton[29] states that pain has little or no relation to acidity, inasmuch as pain is relieved by food and alkalis whether the gastric contents are acid or not, and furthermore, hyperacidity may remain when pain is relieved by treatment.

We must assume that while in some cases perhaps the stomach has hyperæsthesia for acid, acidity alone cannot be the cause of pain.

More recent advances in stomach physiology tend to the conclusion that the adequate stimulus for pain in hollow viscera is tension. Hurst pointed out that observers of gastric sensibility overlooked this factor. Experimental inflation of the stomach tends to a sensation of fullness, when the pressure is raised to 12 or 15 mm. of mercury, and if the inflation is produced rapidly [30] there is actual pain.

Fluoroscopic examination discloses even in the normal fasting stomach peristaltic waves contracting the cavity and giving rise to hunger pangs.[31] It is easy to understand that the exaggerated contractions in the hypertonic organ cause an excessive intragastric pressure, and the muscular tension in the irritable condition causes pain.[32] There is a close relationship between the condition of the stomach in hunger and in ulcer, the difference being largely one of degree of sensitivity. The same mechanism which produces pain also causes fullness, and it is a well-known clinical fact that the characteristic hunger pain of duodenal ulcer is often preceded, it may be for months, by a sensation of fullness.[33]

It is obvious that apart from the hypertonus of the stomach as a whole, one of the main factors in maintaining an increased gastric tension is either an organic obstruction, or a spasm of the pylorus. Spasm of the pylorus may arise from hyperacidity in the stomach itself, for we know that excess of acid passed into the duodenum prevents relaxation of the pylorus, but it may arise from extra-gastric conditions, especially duodenal ulcer, appendicitis, and gall-bladder conditions. The close nervous connection between these organs and the stomach, through the right branch of the vagus and the solar plexus, probably accounts for this pyloric spasm and increased gastric tonus, and explains the epigastric pain so frequently found in these conditions.

Lastly, in spite of the fact that the researches of Carlson are against HCl being a stimulant of peristalsis, and while Cannon found peristalsis and tonus even when the stomach contents are alkaline,[34] the opinion is held generally that we cannot afford in the present state of our knowledge to disregard the chemical factors. While the actual cause of pain is probably the compression of the nerve fibres of the muscularis, it would appear that the hyperperistalsis, hypertonus, and pylorospasm are dependent on a stimulation of the nerve endings in the deeper structures of the stomach when exposed by ulcer, and that the stimulation is brought about by acid or by coarse foods.[35]

This correlation of acidity and tension appears, in the light of experimental evidence and clinical knowledge, to be the most rational

explanation of gastric pain. There is much in the literature on the subject, however, which is conflicting and contradictory, though the steadily increasing degree of unanimity of opinion on the broader questions warrants the assumption that in our researches we are coming nearer the truth, and that in a few years the theories of to-day will have become accepted facts.

BIBLIOGRAPHY.—[1] Cannon, *Amer. Journ. Physiol.*, 1898, vol. i., p. 359. [2] Jefferson, *Journ. Anat. and Physiol.*, 1915, vol. xlix., p. 165. [3] Moritz, *Zeitschr. f. Biol.*, vol. xlii. [4] Keith and Wood Jones, *Journ. Anat. and Physiol.*, 1902, vol. xxxvi., p. 34. [5] Lewis, *Amer. Journ. Anat.*, 1912, vol. xiii., p. 500. [6] Alvarez, *Amer. Journ. Physiol.*, 1914, vol. xxxv., p. 177; 1915, vol. xxxvii., p. 266; *Amer. Journ. Med. Sciences*, 1919, p. 609. [7] Keith, *Lancet*, 1915, vol. ii., p. 371. [8] Alvarez, *Journ. Med. Sciences*, 1919, p. 609, and Child, *Senescence and Rejuvenescence*, Chicago, 1915. [9] Stewart and Barber, *Annals of Surgery*, 1916, vol. lxiv., p. 528. [10] Cannon, *Amer. Journ. Physiol.*, 1906, vol. xvii., p. 429. [11] Bayliss, *Principles of General Physiology*, 1915, p. 534. [12] Cannon, *Amer. Journ. Physiol.*, 1907, vol. xx., p. 283. [13] Spencer Meyer, Rehfuss, and Hawk, *Amer. Journ. Physiol.*, 1916, vol. xxxix, p. 462. [14] Cole, *Amer. Journ. Physiol.*, 1917, vol. xliii., p. 618; *Journ. Amer. Med. Assoc.*, vol. lxi., p. 762. [15] Carlson, Luckardt, and Phillips, *Amer. Journ. Physiol.*, 1919-20, vol. i., pp. 57-66; Rogers and Hardt, *Amer. Journ. Physiol.*, 1915, vol. xxxviii., p. 276. [16] Carlson, *Amer. Journ. Physiol.*, 1915, vol. xxxvii., p. 481. [17] Ehrenreich, *Zeitschr. f. klin. Med.*, 1912, vol. lxxxv., p. 231. [18] Rehfuss and Hawk, *Journ. Amer. Med. Assoc.*, April 1921. [19] Rehfuss, *Journ. Amer. Med. Assoc.*, 1918, p. 1534. [20] Hardt, *Journ. Amer. Med. Assoc.*, 23rd March 1918. [21] Carlson, *Amer. Journ. Physiol.*, 1917, pp. 45, 81. [22] *Journ. Amer. Med. Assoc.*, 1907, p. 836. [23] Meltzer, *Med. Rec. N.Y.*, 1906, vol. lxx., p. 1017. [24] Ritter, *Central. f. Chirur.*, 1908, vol. xxxv., p. 609. [25] Langley, *Brain*, 1903, xxvi., p. 23. [26] Loewenthal, *Berlin. klin. Wchnschr.*, 1892, vol. xxix.; Hertz, Cook, and Schlisinger, *Journ. of Physiol.*, 1908, vol. xxxvii., p. 481. [27] Hertz, *Sensibility of Alimentary Tract*, p. 57. [28] Talma, *Zeitschr. f. klin. Med.*, 1884, vol. vii., p. 407; Einhorn, *Arch. f. Verdaunngskr*, vol. vii., p. 23. [29] Bolton, *Ulcer of Stomach*, London, 1913, p. 149. [30] Hertz, *Sensibility of Alimentary Tract*, pp. 47, 54. [31] Rogers and Hardt, *Amer. Journ. Phys.*, vol. xxxviii., p. 274. [32] Carlson, *Amer. Journ. Physiol.*, vol. xxxi., pp. 151, 175, 212, 318; vol. xxii., pp. 245, 369. [33] Moynihan, *Duodenal Ulcer*, 1912, p. 101; and Hertz, *Sensibility of Alimentary Tract*, p. 59. [34] Cannon, *Amer. Journ. Physiol.*, 1907, vol. xx., p. 299. [35] Ginsburg, Tumpowsky, and Hamburger, *Journ. Amer. Med. Assoc.*, 30th September 1916; Müller, *Muench. med. Woch.*, May 1919. Dragstedt, *Journ. Amer. Med. Assoc.*, 3rd February 1917.

THE CONTROVERSY REGARDING THE PREVENTION OF VENEREAL DISEASES.

By WM. ROBERTSON, M.D., D.P.H., M.R.C.P.

Syphilis and gonorrhœa are infectious conditions. They may, in fact, be placed in the "dangerous" category. Most, if not all, of the acute infections may be prevented by the adoption of simple hygienic safeguards; the mainspring being *sanum corpus*. In other words, men, women, and children who can maintain robust health will, under ordinary conditions, defy infection and its attacks. Venereal diseases are also preventible; but the personal factor plays the big part in prevention. Licentious and immoral people will run their heads into the noose of infection while chaste persons, by refusing to take chances, will escape the risk. That expresses the moral side of prevention which is translated by the campaign of the National Council for Combating Venereal Diseases. The rival organisation which goes by the name of the Society for Preventing Venereal Diseases declares, in so many words, that no matter how much you may preach, teach, lecture, or moralise, there will yet remain immoral persons who will prefer to gratify their sexual desires and to run any risk that may be going. The National Council for Combating Venereal Disease holds strongly to the view that education by skilled men and women should be relied upon for quelling the incidence and spread of the diseases in question. The Preventing Society insists that teaching alone will not suffice, and that every known and reliable means should be employed to prevent infection, more especially when known methods exist. Upon this rock the two organisations split, because the combating side declare that the advocacy of such a preventive as calomel cream incites people to do wrong. But, as has been indicated, the "preventers" affirm that there will be wrong-doers to the end of time and these people should be furnished with a protection against their admitted folly.

If one dare offer a criticism at the outset of the present review, it would be to say that the Minister of Health gave the campaign a disturbed and, one might almost declare, a false start. Reported in *The Times* of 13th May 1921, Sir Alfred Mond expressed himself thus:—"Whilst prepared to assist in the protection of the health of the nation against this dangerous disease, he was not prepared to accede to the demand of those who regarded the question merely from the medical point of view."

No doctor regards venereal diseases as a purely medical subject. It is moral, social, and medical, and is treated from these standpoints in every consulting room and clinic. If we can educate the people of these islands to behave decently, let us employ every argument; if we

can convey the seriousness of the consequences, let us exert our best endeavours. And, if we can devise any satisfactory, safe, and scientific means for cutting down the incidence of the filthy disease and so reduce the increasing costs of treatment, we must not allow surmise and sentiment to distort our outlook. As matters presently stand we have the National Council for Combating Venereal Diseases, backed by the English Ministry of Health and fortified with a grant of £42,000, from tax-payers' money, conducting a vigorous campaign for dealing with venereal diseases from the moral, social, and abortive standpoint. A further grant of nearly £8000 was secured from the tax-payers to enable this body to despatch representatives abroad and to preach propagandism. The opposing society which presses the principle of prevention by the best-known methods receives no grants and has been refused Governmental assistance.

The outcome of conferences between the two associations has been agreement on the doctrine of "immediate self-disinfection." Arising out of that agreement, the English Ministry of Health issued a pamphlet, in which the following advice appeared: "*It is the duty of all individuals who have incurred or think they have incurred risk of an infecting disease to clean themselves thoroughly and immediately, and thereby diminish the risk.*" The casual reader is inclined to ask, "What, after all, is the difference in the policy of the two bodies?" Narrowed down to a fine point, it appears to be this. One Society declares against any scientific attempt to avoid or prevent infection, but it offers no objection to seeking to disinfect immediately after incurring risk. It also strongly advocates treatment to effect cure and to prevent the spreading of infection. The rival school holds that, in addition to teaching, it is better to employ calomel cream of reliable strength or other satisfactory method in the confident hope that gonococci or spirochætes may be prevented from establishing themselves.

In the December number of the *International Journal of Public Health*, which is published by The League of Red Cross Societies, two interesting articles appear. A résumé of these will be instructive, since they clearly indicate the divergent policies of the opposing organisations. The case for self-disinfection is dealt with in characteristically vigorous style by Sir G. Archdall Reid. The case against is in the hands of Dr Otto May.

It will be safer to quote some of Sir Archdall Reid rather than attempt to translate his decided opinions:—

"In 1913 a Royal Commission was appointed to consider, among other things, the subject of prevention. Dominated by its clerical and female members it ignored prevention. The public were left to infer that there was no such thing. Yet, when it presented its report in 1916, calomel cream was under employment for the protection of 20,000,000 fighting men. The Commission advised the Government to increase the facilities for

exhorting prospective sinners and for the medical treatment of those already infected. We have already estimated the potency of exhortation, and never yet has the prevalence of any disease been materially lessened by the mere treatment of the sick. In addition, the Commission warmly commended to the Government, for its future guidance, the newly formed National Council for Combating Venereal Disease. In other words, it warmly commended itself, for the Chairman of the one became the President of the other, and was accompanied to the directorate of the latter by about half his colleagues." Sir Archdall Reid quotes several instances where self-disinfection was practised with good results in the army. "Before the war the 1st Batt. of the Yorkshire Regiment was in a hill sanatorium in India. Since women were absent there was no venereal disease. The battalion was ordered to Delhi, a notorious hot-bed of infection. The commanding officer, in alarm, consulted with the surgeon, who advised the men to disinfect with a solution of permanganate of potash immediately after danger was incurred. In the next four years that battalion had only six cases of infection instead of about 1000." "During the war the Australian troops in Egypt were being infected at the rate of 800 or 1000 a day. Sir James Barrett introduced Prophylaxis." "Where prophylaxis was properly taught and applied, venereal diseases were practically non-existent. The lesson taught by experience in Egypt was that all social methods combined resulted in a limited reduction in the incidence of venereal diseases, and that unless some form of prophylaxis were adopted many infections were certain to result."

One of the arguments raised against the "Preventing" society has been that its policy meant the placing of packets with instructions in the hands of every boy and girl. Sir Archdall Reid declares, "I fear that those who repeat that accusation are deliberately inaccurate. The Society has repudiated the suggestion many times."

Turning to the other side we quote Dr Otto May:—

"The means employed by this body (National Council for Combating Venereal Diseases) have aimed at the prevention of these diseases in two principal ways:

1. By efforts to raise the standard of conduct so as to diminish the amount of sexual promiscuity.
2. By organization of wide facilities for the free treatment of the diseases so as to minimize the risk of contagion should intercourse occur."

Dr Otto May's second claim must not be taken too literally, however, since his council has nothing to do with organising treatment schemes. That is a policy which rests entirely in the hands of local authorities.

Dr Otto May takes exception to the following which was contained in a leaflet issued by the Society for Preventing Venereal Diseases. "It is obvious that the best way of avoiding venereal diseases is to abstain from sexual intercourse. Venereal disease can be prevented with

almost complete certainty if the right precaution be taken in time." Dr May says, "If, therefore, the methods advocated by the Society for the Prevention of Venereal Diseases are adopted on a large scale, it means that every adolescent and adult (The Society for P. V. D. has never said so.—W. R.) will carry about a packet of disinfectants as an emergency in case of exposure to the risk of venereal infection. Do the members of the Society realize the full implication of this fact? Are they willing to instruct their own boys of 16 or 17 constantly to carry such a packet? (Sir Archdall Reid's Society has denied any such intention.—W. R.) Can they doubt that, in such cases the possession of the packet will act as a continued reminder of their sexual function, and will stimulate them to seek opportunities of testing the packet's vaunted power of preventing infection?" Dr Otto May insists that there is "positive encouragement inseparable from the issue of a pamphlet such as that quoted above." The policy of the Society for Preventing Venereal Disease "is calculated to increase sexual misconduct, not so much by removing the fear of infection, as by a direct encouragement to young men to indulge in their sexual appetite." One is tempted to ask why admit that there is a sexual appetite? If such appetite be admitted, some scheme of prevention would appear to be rendered highly necessary. Moralising will not blunt sexual appetite in a sensual individual. Dr May affirms that his party advocates self-disinfection not as a practical certainty but as a "poor second" to continence. Presumably Sir Archdall Reid would add "we also believe that chastity is far in front of prophylaxis or the employment of immediate self-disinfection." Dr May finally suggests that there is no fundamental point at issue between the two societies. But he hazards the opinion that his rivals attach too great a value to the instruction of the civilian population in the methods of self-disinfection which the National Council regards as disproportionate and unjustified by evidence. (Sir Archdall Reid cites the evidence from Egypt and elsewhere in support of his argument.—W. R.) Dr May maintains that the instruction of adolescents by pamphlets is dangerous, and calculated to do more harm than good. Preference is given to teaching by the spoken word of medical men and women as part of the whole subject of sex hygiene and conduct. But the reader must keep in mind that Sir Archdall Reid's Society depends entirely upon voluntary effort to keep it going. It cannot afford to pay medical men and women to travel about the country to spread the truth of prevention. If it received a grant of £40,000 or even £20,000 it might be able to dispense with pamphlets. Dr Otto May makes a strong point by quoting the experiences of Germany where prevention has been tried and given up because venereal diseases have increased. That would not have been Germany's experience had military discipline not been relaxed.

The Prevention of Venereal Diseases

The Germany of to-day is not the *Streng Verboten* country which some of us have known. The same could be said of our own social conditions and morals. But one could logically say to Dr May that despite the efforts of his Council and its excellent work the incidence of venereal diseases in England, Wales, and Scotland has risen by leaps and bounds, if statistical evidence and clinic records are to be taken as indications.

What are the Real Facts?

Leaving academic discussion aside, let us come down to actual facts. Propagandism is a good thing, if properly directed, but in the case of battling against venereal diseases propaganda are to be likened to veneer. They do not grapple with the actual question of preventive medicine, and public health is but a compartment of prevention.

The moralising campaign will do good, but you can moralise till Doomsday, there will always be "bad" men and women in every village, town, and city of this and other countries. Moralising will reach a certain class of society; the substratum has no ears for preaching or teaching. It goes on its way living from day to day heedless of consequences, and growing more and more accustomed to be assisted by the State when old age, infirmity, or disease overtake the individual. Even prophylaxis or immediate self-disinfection will not interest them, unless the means are placed under their very noses.

Self-disinfection and prophylaxis are not dependable, unless they be properly and skilfully performed. Our experiences at the Central Venereal Diseases Hospital for Scotland during the war proved that only careful and patient instruction could assure correct use of the irrigation apparatus. The mere cleansing of the meatus with a glass syringe charged with Condy's fluid does not constitute self-disinfection. Soap and water must also be lathered about the vulnerable parts. Gonorrhœa is not the only condition that may attack a man or woman after *coitus*. Self-disinfection on the part of females untrained in the art of douching can almost be discounted. Calomel cream to be of value must be used in proper strength and most carefully rubbed into the *pudenda*. An intoxicated man cannot be relied upon to use calomel cream in such a way as will amply protect him. Calomel cream cannot be applied by a female for her own protection.

Self-disinfection or prophylaxis must be immediately and very thoroughly performed to afford hope of real success. Calomel cream can be efficacious. Metchnikoff and Roux experimentally proved that it could prevent syphilis. Every V.D. clinical officer and attendant has immediate recourse to calomel cream should the necessity arise for protecting wounded or abraded fingers, etc.

Moralising we cannot discount, but we regretfully know that, despite one or even more attacks of gonorrhœa or syphilis, men and women

return to receive treatment for fresh infections. Such people are to be classed among that section which appears to have no conscience or care. Packets are only of value in the hands of those who know how to employ them to the best advantage.

Self-disinfection is being practised in Manchester. The results are being carefully watched.

We are now being forced to consider the provision of special disinfection centres, where skilled attendants will receive and instruct those who have incurred the risk of infection.

This practice when applied to females would require to be conducted in or at a V.D. clinic. It could not be carried out in a public urinal.

The wholesale distribution of packets to civilians does not commend itself. The correct and timely application of calomel cream as occasion demands has much to be said in its favour, because it is a part and parcel of preventive medicine. Our costs for treatment are increasing by leaps and bounds, and only a few local authorities have undertaken the administrative task in a determined and scientific manner. We should therefore do everything that lies in our power to prevent or abort venereal disease, and so lessen the burden of the tax-payer, and cut down the risk of spread to a minimum.

Administrative Action.

While in America and in several of our Colonial possessions the nettle has been firmly gripped by the institution of some form of compulsory notification, our supersensitive country fights shy of getting at the real root of a social sore. We prefer to lecture about morals rather than control wrong-doers. Now let us examine some of the anomalies that exist to tie the hands of those who are eager to come to grips with venereal diseases. Men and women may cease to attend a clinic for treatment and advice. Clinical medical officers tell us that 30, 40, or even 60 per cent. of their patients fail to complete their courses of treatment. The administrative officer is given no legal weapon to compel a completion of treatment. It must be done by persuasion, and often the patient is more or less inaccessible. A man may infect a woman, or *vice versa*. No power is available for compelling the known mischief-maker to submit to examination or treatment. Persuasion is the sole recourse. A child must be notified when suffering from gonorrhœal ophthalmia. The mother may present herself to the doctor, but the father who has probably infected the mother cannot be forced to get his urethra examined or appropriately treated. The practitioner is not required to notify venereal diseases, but he may secure salvarsan for treatment if he can show proficiency in its administration. Objection to notification has been based on two main

grounds, first the difficulty in devising a scheme, and secondly the dread of revealing professional secrecy.

Any one who cares to visit a busy clinic will be amazed to observe a room filled with men sitting side by side and waiting to see the doctor. The same may be observed in a women's clinic. Secrecy does not trouble these people. They want to be cured. Yet they may live next door to one another, or come from the same country town or village. The publicity of the waiting-room does not act as a deterrent. The increasing attendances justify one in saying so.

Medical men do not betray secrets. Medical officers of health and clinical medical officers never discuss the secrets of their departments with outsiders. Not a single member of a Public Health Committee knows the names of the patients removed to hospital, nor of those who are notified as suffering from any form of infectious disease. Only those intimately connected with the administrative machine possess the "inside" information. Secrecy is more likely to be assured in the case of venereal diseases, because ambulance vans will rarely call for removals, and disinfecting officers will seldom be required. In short the existence of notified cases can be confined to the knowledge of the medical officer of health, the clinical medical officer, and the patient. Each can be depended on to maintain secrecy.

Notification of venereal diseases has now passed the experimental stage. It has been put into force and is being perfected. Statistics are showing that gonorrhœal ophthalmia is on the increase. If that be an index of the prevalence of venereal disease, the reason for the enforcement of compulsory notification is the more urgent.

In forty-two American States notification of venereal diseases holds sway. Australia, New Zealand, and other Colonies have introduced schemes for securing notification. The objections that we hear in this country were also raised in these countries where notification has been adopted. There are always objectors to every progressive procedure.

Venereal diseases can be notified by numbers and not by divulging names. Take the subjoined as a tentative suggestion of notification by the medical man.

I beg to notify Case No..... *Male (Female).* *Age.....*
Married or Single. *Diseased Condition.....*
The history of the case has been duly recorded by me.
The patient is receiving treatment from me; or,
The patient was sent to the Public Clinic.

In that form the patient's name and address are omitted. But the name and address and history are noted in a book supplied to the practitioner by the local authority. These books containing full particulars of cases and their courses of treatment would prove of immense value when statistics came to be compiled.

Many of the cases notified by medical men will be advised to seek treatment at a Municipal Clinic, because adequate means do not exist in the private practitioner's rooms, nor in the patient's home. The treatment of gonorrhœa and syphilis will thereby be vastly improved. It calls for much improvement. The amount of care and attention given to effect the cure of gleet, or posterior urethritis of gonorrhœal origin would surprise many. The establishment of notification would encourage the taking of smears from suspicious sores, as well as from urethral and vaginal discharges. Medical men would be provided with outfits for taking smears, and also for collecting blood for Wassermann tests. Without notification there is literally free licence afforded to spread infection. Armed with notification the penal weapon can be threatened should an infected and improperly treated individual continue at large.

The objections now offered to compulsory notification in this country had all been voiced with the same monotony in America and elsewhere. They have been overcome because the people have gained confidence in the tact and good sense of administering authorities. Also, where the methods of treatment have been skilfully and scientifically applied the infected population has voluntarily offered itself for treatment. There has been, in fact, voluntary notification. Some authorities are satisfied that voluntary notification is sufficient. It is not. If it were satisfactory the attendances at V.D. clinics would not continue to increase. There must be human agencies at work to maintain the constant stream. In any case, it is most essential that the man or woman who, after several attendances at clinics, suddenly ceases to return, must be compelled, under threat of confinement or adequate punishment, to complete the course.

The aid of the police and the Law Courts must not be suggested unless one is confronted with criminals, hopelessly diseased persons, or mental defectives.

Compulsory measures for dealing with venereal diseases are not new. From Creighton's *History of the Great Epidemics* one learns that the "Pockie" people of Edinburgh were sent to Inchkeith to be treated and kept out of mischief. The Aberdeen authorities bundled every person known to be suffering from venereal disease out of the gates of the town. Our methods are a distinct refinement of what, even in the Middle Ages, was considered to be a highly desirable procedure. Most of the Acts for controlling venereal diseases are founded on the Statute passed in Australia in 1915. Powers are given to examine suspects, and also completely to prohibit brothels.

This country is ripe for notification, and with the establishment of treatment centres in our principal towns and cities, we shall be quite ready to deal with the vast majority of notified cases.

The Prevention of Venereal Diseases

In conclusion one is tempted to offer the suggestion to the rival organisations trying hard to prevent the spread of venereal disease that they should prepare the citizens for notification. If a vote were taken at the present time it is certain that the people would support and carry notification by an overwhelming majority. They have read and heard enough to convince them that we are not doing what we should to control the spread of loathsome disease. The cost of treatment is very heavy. It is an onus upon the clean section of society. The onus can be relieved if more effective control be instituted.

OBITUARY

THE LATE SIR GERMAN SIMS WOODHEAD.

By the death of German Sims Woodhead, which took place on 29th December 1921, the Edinburgh Medical School has lost one of its most distinguished and loyal sons. Woodhead was the son of a prominent Yorkshire newspaper proprietor, and was born in Huddersfield in 1855. He came to Edinburgh in 1873 to pursue his medical studies. During his student days he was a leading figure in the athletic and social life of the University, and from the first his character made a deep impression on his contemporaries. After graduation, in 1877, he occupied the usual junior positions which come to an outstanding young graduate, the most notable being his Presidentship of the Royal Medical Society.

On returning from a period of study abroad, he was drawn into pathology by the influence of D. J. Hamilton, who suggested a research on the effect of locomotor ataxia on the structure of the medulla. This work was submitted as a graduation thesis for the Doctor's degree, and was awarded a gold medal. When Greenfield became Professor of Pathology in 1881, Woodhead was appointed his first assistant, and in this position he rapidly attained distinction by his clear and vigorous teaching. In 1883 he produced his *Practical Pathology*, the appearance of which marked a new departure in text-book literature; for thirty years in successive editions it has brought distinction to the Edinburgh school. Woodhead took a leading part in the movement in Edinburgh towards research, which originated between 1880 and 1890, and he was the first Superintendent of the Royal College of Physicians' Laboratory, and one of the originators and the first Secretary of the Pathological Club. His success in organising the Laboratory led to his transference to London in 1890 to perform a similar function in the newly-started Conjoint Laboratory of the Royal College of Physicians, London, and the Royal College of Surgeons, England. Here, although the conditions were not so favourable as in Edinburgh, considerable success attended his efforts, and his personal contributions ranged over a wide field of enquiry, but were specially notable in connection with the development of Behring's antitoxin treatment for diphtheria, which Woodhead did much to place on a secure basis.

In 1899 he was called to the Chair of Pathology in Cambridge. There he had a difficult part to play, as the choice had fallen on him largely on account of his attitude towards Pathology as being a subject essentially related to the practical requirements of Medicine.

1321

[*Photo by Russell*

SIR GERMAN SIMS WOODHEAD, K.B.E., M.D., LL.D.
As Major, R.A.M.C. (T.)

He thus had a hard task set him in developing such a view in a school which provides only the scientific part of the medical curriculum. He, however, took full advantage of the opportunities for adjusting his teaching to the conditions which prevailed, and he was instrumental in providing the University with well-equipped medical laboratories. When, soon after going to Cambridge, he was appointed a member of the Royal Commission on Tuberculosis in 1901, Woodhead was drawn into what became his chief life-work. The labours of this Commission, extending over twelve years, played a dominant part in establishing, in opposition to Koch's view, the infectivity of the bovine bacillus for man, and in its enquiries Woodhead took a leading share, being largely responsible for the experimental work on which its Report was based. As a result, he became one of the chief authorities on every aspect of tuberculosis.

From his earliest graduate days Woodhead had been an enthusiastic supporter of the Volunteer Medical Corps, even before it received official recognition, and he was an officer in the Territorial Force. On the outbreak of the European War he was mobilised, and was put in medical charge of the Irish Command Depot in Tipperary. Here, as the War progressed, he devoted himself to the training of the maimed soldier with noteworthy success. Later, he acted as Consultant to the War Office and as Inspector of Laboratories throughout the Kingdom. Towards the end of the War the problem of the tuberculous soldier attracted his attention, and his last notable work was the organisation of village colonies where tuberculous patients could find such employment as their state of health permitted. This development of sanatorium treatment is probably destined to produce valuable results, and it is to be regretted that Woodhead did not see the complete fulfilment of his plans. For some years past Woodhead was in failing health, but up to the end he courageously devoted himself with wonderful energy to whatever he had at heart.

Woodhead was essentially one of the doers of the world's work. There has been practically no development of his subject during the last forty years in which he has not had a hand. He founded the *Journal of Pathology and Bacteriology;* he was one of the leading supporters of the Pathological Society of Great Britain and Ireland; he was a member of the Executive of the Imperial Cancer Research Fund; as one of the Treasury Committee who, under Lord Elgin, had to consider the financial position of the Scottish Universities he exhibited a keen interest in promoting the efficiency of University teaching in Scotland, and there was scarcely an appointment to a chair of Pathology or Bacteriology in the British Empire in connection with which his advice was not sought. He was unwearied in his efforts

in every good cause. A lifelong total abstainer, he would travel from one end of the country to the other to support the temperance movement by lectures and addresses on its scientific aspects; and as a loyal Congregationalist he was prominent in Church work.

The keynote of Woodhead's character and of the influence which diffused from him lay in the fact that he was a great practising Christian. His goodness was wholly unostentatious, and rarely is there found such selflessness and self-effacement as he exhibited. To have his friendship was to have a great possession, and those who enjoyed it will ever recall with unalloyed pleasure his cheerfulness and quiet humour, his energy, his charity, and the calm and sane outlook with which he regarded every situation with which he had to deal.

J. R.

[A complete bibliography of Sir G. Sims Woodhead's scientific writings will be found in the *Journal of Pathology and Bacteriology*, vol. xxv., 1922.—EDITORS.]

NEW BOOKS

Heart Disease and Pregnancy. By Sir JAMES MACKENZIE. Pp. xiv. + 138, with 21 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price 8s. 6d. net.

Sir James Mackenzie has given us a compact and clearly written volume enunciating his well-known views on cardiac disease with special reference to pregnancy. The book will, however, appeal to an even wider circle than even the obstetricians whom the author thinks are still wandering in outer darkness so far as knowledge of cardiac disease goes, and perhaps he is right.

He believes that before the discovery of auscultation and the use of the stethoscope about 100 years ago, a juster estimate was reached as to the functional efficiency of the heart than that which has been attained to since the introduction of mechanical devices. In fact, that the coming of the stethoscope was the beginning of a method in clinical research which has greatly hindered the practice of medicine, owing to erroneous deductions therefrom, and an undue preponderating importance being given to mere modification of sounds, which later experience has shown was not justified—in fact a sign was found, and it was called a disease.

Sir James effectually disposes of the familiar idea that the left ventricle hypertrophies during pregnancy. He shows that the forcible apex-beat of hypertrophy does not present itself in healthy pregnant women. The changes in the shape of the heart are not due to hypertrophy. On the contrary, we have a complete explanation of these changes in the displacement of the organ and the widening of the chest caused by the uterine tumour.

Great stress is laid on the standard of the heart's efficiency and the law of heart failure. The importance of the earliest recognition of the first symptoms of a failing heart is strongly emphasised, and in fact is the main thesis of the book. It is significantly noted that one of the earliest signs of danger in a pregnancy complicated by heart disease is crepitation at the base of the lungs. He says that in no field of medicine, so far as he knows, has the attitude towards murmurs proved so disastrous as in pregnancy. The detection of an innocent murmur has often supplied a reason for forbidding pregnancy or even marriage. The danger of pregnancy associated with auricular filarillation is fully discussed, as well as the methods of differential diagnosis, and of estimating the efficiency of the myocardium.

In a useful chapter on the management of pregnancy and labour in heart disease, no reference is made to the value of venesection in some cases of sudden heart failure in mitral stenosis, after the labour is

completed. The writer has seen two cases where life was saved by this treatment. Sir James Mackenzie's shrewd observations and advice, and vigorous advocacy of his views are helpful and enlightening.

Ligation of the Left Subclavian in its First Part. By W. S. Halsted, M.D. The Johns Hopkins Hospital Reports, vol. xxi., fasciculus 1. Pp. 96, with 11 plates. Baltimore: The Johns Hopkins Press.

Dr Halsted has on two occasions ligated the first portion of the left subclavian artery for subclavian aneurysm. The observations made on these cases form the basis of a monograph which is distinguished by its literary style, by historical references, and by the scientific presentation of the subject. Complete details of the twenty-one cases in which this operation has been performed are recorded, together with excellent plates to illustrate anatomical details and the various procedures which have been employed. The mortality rate of such a formidable operation is surprisingly small. All of the ten cases of ligation of the first part of the left subclavian, operated upon in the last decade, made a good recovery. It is established that in the absence of complications there is no risk of gangrene, and that ligation is sufficient to cure the majority of cases. In one of Halsted's cases it was necessary to excise the aneurysmal sac, on account of return of pulsation and increased swelling, two years after ligation of the left common carotid and first subclavian arteries. Many points of great interest in the treatment of aneurysm and in relation to the ligation of the main arterial trunks are discussed at length, and we can most heartily recommend this brilliant contribution to the surgery of aneurysm to the notice of surgeons.

Developmental Pathology: A Study in Degenerative Evolution. By Eugene S. Talbot. Pp. xxii + 435, with 346 illustrations. Edinburgh: E. & S. Livingstone. 1921. Price 25s.

Of the numerous publications from the pen of this Professor of Stomatology (detailed on pp. 424 to 427), probably the best known in this country are *Degeneracy* (The Contemporary Science Series), and *The Etiology of Osseous Deformities of the Head, Face, Jaws, and Teeth*, which reached its third edition so long ago as 1894, and the volume under review is a *réchauffé* of these two works. The first six chapters, dealing with the development of organs, cannot add to the author's reputation for either knowledge or accuracy; they had been better omitted. As the author approaches the consideration of the face, however, he becomes more at home, while the latter half of the book, dealing with the mouth, teeth, and jaws, shows him at his best.

The book is well got up, the type clear and distinct, the paper good, and the illustrations on the whole acceptable. In the reviewer's opinion the diminution in size has lessened the value of some of the pictures, as compared with their original production. There is evidence of careless proof-revision, as in "occipals" (p. 60, l. 12), "subclavians" and "arteria in nominata" (Fig. 26), and "abberation" p. 93, l. 35). Some of his statements require emendation, if not deletion. Thus (p. 65) "To the factors underlying this condition (*i.e.* synostosis) is seen the failure of increase in intellect after puberty in the higher apes and the lower human races." Surely not! While in writing of "the durencephalous child which so often appears in degenerate families," he has evidently no knowledge of the recent researches in anencephaly with which Edinburgh has enlightened the profession. The addition of photomicrographs in the section on the gums and teeth fills a blank.

While acknowledging each borrowed illustration, as the author honourably does, it seems unnecessary that every one of his own should be marked "(original);" but perhaps we do not appreciate our freedom from plagiarism in this country. Some of the physiognomy portrayed appeal to one's sense of humour. In Fig. 117—"A ward politician, an habitual liar (original)," the reviewer imagines he can trace features of parliamentarians with whom he does not agree. Fig. 123—"A successful lawyer (original)" might, with advantage, be exhibited in prisons as a warning to prisoners what other environment might have made them; and Fig. 106—"Habitual criminal, horse-thief (original)" might be distributed to the bar as a featural type they should endeavour to attain. Thus has our faith in Lombroso departed!

Zoology for Medical Students. By J. Graham Kerr. Pp. viii + 485, with 199 illustrations. London: Macmillan & Co. 1921. Price 25s. net.

Professor Kerr has brought together in this well-produced volume the substance of his lectures in Zoology for medical students in the University of Glasgow. He begins with Amœba and works through the animal kingdom, but has deliberately excluded an account of the anatomy of the higher vertebrates. The chapter on Protozoa (82 pp.) is excellently done, although in some parts rather too detailed for the first-year student. In his reference to recurrences in malaria the author gives a place to Schaudinn's explanation—that the macrogametocyte is resistant, and may, after a long dormant period, burst again into activity and undergo a sexual reproduction. Recent work has given no support to this view. In the account of Paramecium reference might have been made to the important work of Woodruff,

who has maintained a culture of this ciliate through more than 8000 generations without conjugation having taken place. In the chapter on Annelids an account of the development of the mesoderm and cœlom (*e.g.* in Polygordius) would have been helpful. Most teachers of first-year medical students would willingly sacrifice the chapters on sponges and echinoderms, some of the details of other invertebrate groups, and much of the second chapter on fishes—good as it is—if thereby space for a fuller account of the mammalia (which occupies only 12 pp.) could have been afforded.

The author has presented the main facts of morphology and development in the groups chosen for detailed treatment with great lucidity, and he has been fortunate in securing the services of Mr A. K. Maxwell for the preparation of the many original figures which embellish the book.

The Intestinal Protozoa of Man. By Clifford Dobell, M.A., F.R.S., and F. W. O'Connor, M.R.C.S., L.R.C.P., D.T.M. & H. Pp. xi + 211, with two text-figures and 8 plates. London: Published for the Medical Research Council by John Bale, Sons, & Danielsson, Ltd. 1921. Price 15s. 6d.

This book gives an admirable and concise account of the characters, methods of examination, life-history and modes of transmission of the intestinal protozoa recorded from man. Seventeen species are considered, belonging to thirteen genera, but of these only two—*Entamœba histolytica* and *Balantidium coli* are truly parasitic; most of the remainder are harmless commensals. Clear directions are given for the collection of material, the commoner sources of error in diagnosis are pointed out, and there is a critical summary of the methods of treatment. Appended is a full bibliography (18 pp.) of the subject. The eight plates are beautifully executed; the last plate, which is divided into three panels, contains representations of the cysts of the principal species as they appear when alive, when examined in iodine solution, and after fixation and staining with iron-hæmatoxylin.

A Pocket Surgery. By D. C. L. Fitzwilliams, C.M.G., M.D., Ch.M., F.R.C.S. (Edin. and Eng.). Pp. 348. London: Edwin Arnold. 1921. Price 10s. 6d. net.

As the author has pointed out, the book is not intended as a text-book on surgery, but rather as a key to the cupboard in the student's brain in which the mass of detail must be stored. Keeping this in view, the book is an admirable compendium of facts. The author has been able to crowd a large amount of information into the small space of three hundred odd pages. There are, however, one or two

omissions: in the text, the diseases of the spleen and pancreas are not mentioned; in the index, at the end of the book, the prostate is not included, although there is a chapter devoted to the diseases of that organ. A suitable book for the student as a final revision.

FOREIGN BOOK

Nouveau Traité de Médecine. Edited by G. H. Roger, Fernand Widal, and J. Teissier. Fascicule III.: "Maladies Infectienses" (suite). Pp. 556, 4 colour-plates. Price 40 francs, net. Fascicule VII.: "Avitaminoses," "Maladies par agents Physiques," "Troubles de la Nutrition." Pp. 552. Price 35 francs, net. Paris: Masson et Cie. 1921.

The second and third instalments of this comprehensive treatise on medicine fully confirm the very high opinion which was expressed a few months ago when the first volume was reviewed. Nearly a half of fasciculus III. is devoted to typhoid and paratyphoid fever, and, written as it is by M. Widal, incorporating all that has been learned during the War as to the "enterica group," this article will assuredly become a classic. The symptomatology of these infections is depicted with a masterly hand, but what many readers will turn to with most interest is the writer's opinion of the diagnostic value of agglutination tests in T.A.B. inoculated subjects. Widal holds that sero-diagnosis is useless within two months of inoculation; after that agglutination titers above 300 for typhoid, 100 for A, and 200 for B should be regarded as positive serial tests, of course, are also advised. He also draws attention to the possible value of examining bile, withdrawn by a duodenal sound, for bacilli. The value of prophylactic vaccination is sufficiently illustrated by statistics from the French Army:—five months of 1914, 45,078 cases with 5479 deaths; 1918, 757 cases with 111 deaths. Widal and Lemierre are also responsible for the article on coli-bacillosis or B-coli septicæmia, which sets forth many new aspects of the condition. The other maladies dealt with are bacillary and amœbic dysentery by Dopter, Cholera by Ruffer, Botulism and Malta Fever by Sacquépée, Trench Fever by Strong, Influenza by Menetrier and Stevenin, Plague by Sacquépée, and Yellow Fever by Sodré. Dopter places what seems to the reviewer undue reliance on sero-diagnosis on bacillary dysentery. He speaks with moderate fervour of the serum treatment of the disease. Strong's article on Trench fever is of great interest both clinically and historically. The relation of the disease to previously known fevers is left unsettled.

In fasciculus VII. the articles which will attract most attention are those on Vitamines and on Diabetes. Roger gives an admirable summary of our knowledge of the vitamines and their rôle in health and disease, and this is followed by papers on scurvy, both adult and infantile, pellagra and beri-beri by Benvil, Alfaro, and others. In the bibliographies appended full justice is done to the labours of English and American workers in the field. The etiology of pellagra is not regarded as being on so firm a basis as that of scurvy and of beri-beri, the two theories most favoured by the author being that the disease is due to deficiency of vitamine, and to a diet poor in absorbable protein. Paquiez treats of anaphylaxis in human pathology. His article is comparatively short, but covers the ground well, and is full of suggestion. The notion that fatalities occasionally ascribed to intestinal parasites may be due to anaphylactic shock is a novel and interesting one. The reviewer recollects a case of tape-worm in which the sudden fatal collapse was attributed to an unduly large dose of male fern, but the symptoms (it was before a knowledge of anaphylaxis was general) might well have been due to anaphylaxis. The relation of anaphylaxis to any idiosyncrasy is well brought out. In addition to diabetes, Le Gendre treats of other nutritional diseases—emaciation, obesity, gout, etc. The hints given as to the dietetic treatment of obesity are sound and practical. The article on diabetes is very strong on the purely clinical and pathological aspects of the disease. We miss any detailed reference to Allen's method of treatment. The subject of renal diabetes is briefly referred to, and under the head of "pseudo diabetes" there is a description of polyuria with increased excretion of urea (azoturia), and of azoturia without polyuria. Apparently diabetes insipidus due to dyspituitarism is included in this group.

Space forbids any attempt at a more detailed criticism of these two volumes. It only remains to be said that they are thoroughly representative of the best contemporary French medicine, and that they reflect the highest credit on all concerned in their production. They are beautifully printed volumes, of convenient size, and well bound, all of which may be secondary matters, but greatly contribute to the comfort of the reader.

NEW EDITIONS

Manual of Surgery. By Alexis Thomson and Alexander Miles. Volume I., pp. 565, with 169 illustrations. Vol. II., pp. 659, with 288 illustrations. Volume III., pp. 566, with 166 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. 12s. 6d. per volume.

This work is now presented in three volumes, a form which is decidedly more convenient to the reader. The first is devoted to general surgery; the second to the surgery of the extremities and the head and neck; while the third volume deals with the surgery of the thorax and abdomen. The text has been revised throughout and partially re-arranged. The subject-matter has been condensed, and recent advances that are deemed of lasting importance in civil surgery have been incorporated. Many illustrations have been replaced by better, and the total number has been considerably increased. Details of operative procedure have been further eliminated, since this subject is fully dealt with in the companion volume on Operative Surgery, the third edition of which appeared some months ago.

The rapid succession of new editions and second impressions of this manual is eloquent proof of its value and excellence. Though concise, the manual is comprehensive, and furnishes an authoritative account of modern surgery, which is not only of value to the undergraduate but also as a work of reference to the practitioner. The reviewer is confident that the present edition will maintain the traditions established by former editions.

The Chemistry of Colloids and Some Technical Applications. By W. W. Taylor, M.A., D.Sc. Second Edition. Pp. viii. + 332, with 22 illustrations. London: Edward Arnold & Co. 1921. Price 10s. 6d. net.

In the preface to his first edition, Dr Taylor remarked on the curious fact that, although colloid chemistry owes its development in no small degree to British investigators, no text-book on the subject was available in English. Since then one or two of the larger German works have been translated, and E. F. Burton's monograph on "The Physical Properties of Colloidal Solutions" has appeared, but Dr Taylor's book still remains one of the principal sources accessible to students ignorant of German. We are naturally tempted to compare it with the larger works by Freundlich, Zsigmondy and Ostwald, and to A. Müller's *Allgemeine Chemie der Kolloide*, which alone it resembles in size.

The characteristics of Dr Taylor's book are partly determined by its origin from a course of lectures to advanced students of chemistry. The mathematical and physico-chemical equipment of his audience doubtless enabled Dr Taylor to be brief in his explanations, but unfortunately the many who are interested in colloids for biological or technical reasons will find this brevity troublesome; for instance, those who are new to the subject will hardly understand the very condensed account on pp. 34-35 of Perrin's important experiments. Readers of this journal will naturally be most interested in the last chapter, dealing with the applications of colloid chemistry to biology, but here want of space seems to have excluded much that is of interest to the student of medicine, nor is such a work as H. Bechhold's *Die Kolloide in Biologie und Medizin* mentioned. The section on the equilibrium between blood and oxygen is hardly up to date, for it contains no reference to the important work of English physiologists during the last decade.

Occasionally Dr Taylor takes liberties with scientific nomenclature. "Lab" is not usual in English for "rennin," and typhoid (not typhus) bacilli is the translation of the German Typhusbazillen.

Too much importance should not, however, be attached to these minor defects. In a small compass the book contains a considerable amount of information, both theoretical and practical. It is, in general, lucidly written and contains numerous references to original papers. Its value might be still further increased by a select, annotated list of text-books and monographs, now fairly numerous, on the subject, which has, moreover, a journal exclusively devoted to its interests.

Sanitary Law and Practice. By W. Robertson, M.D., D.P.H., and Charles Porter, M.D., B.Sc. Fifth Edition. Pp. 758, illustrated. London: Sanitary Publishing Co., Ltd. 1921. Price 18s. 6d. net.

This book first appeared in 1904, and has now reached its fifth edition. It is a good book, well fitted both in design and in general execution to assist the student in his earlier encounters with sanitary law and practice. Each part of the subject is dealt with separately—the relative enactments being quoted in full or epitomised, and the section concluded by an enumeration of the duties of the health official. In this the official's powers and his limitations are defined, and sound advice is given as to what he can and should do in present circumstances, and what ideals of sanitation he should strive for in the future. In a work dealing with so many changeable factors there are bound to be both omissions and slips. In this edition there is some evidence of haste. The description of the activated

sludge process, for instance, is not so full or clear as the importance of the process warrants. It is a matter of regret, too, that the authors—the caveat in the preface notwithstanding — retain throughout the volume the obsolete title of Local Government Board, when referring to the Scottish Board of Health. In the index a number of items which should appear under the letter M are awanting — probably owing to the loss of a page of manuscript—but this should not have escaped the proof reader's eye.

A Text-book of Special Pathology. By J. M. Beattie, M.A., M.D. Edin., M.R.C.S., L.R.C.P., and W. E. Carnegie Dickson, M.D., B.Sc., F.R.C.P. Edin. Second Edition. London: William Heinemann. 1921. Price 31s. 6d.

The new edition of this justly popular text-book has been thoroughly overhauled and several chapters have been practically rewritten. New material has been added, on paratyphoid, dysentery, infective jaundice, T.N.T. poisoning, and diabetes mellitus, and the sections dealing with diseases of the prostate and the pituitary have been greatly extended. More space has also been given to descriptions of the results of mechanical injuries.

No text-book of pathology can be an adequate substitute for practical experience in post-mortem and histological work, but the student has need of a well-illustrated work to remind him, during his studies, of the appearances of pathological structures he has already examined. The abundance of good reproductions in this book is one of its most valuable features, although the details of some of the pictures are so delicate that they do not show to full advantage on the paper employed.

The subject matter is arranged under the various systems, the pathological conditions affecting each organ being taken up *seriatim*. The less important subjects occupy little space, but the principal diseases are fully discussed with regard to their etiology, and progress and careful accounts of the histological and naked-eye changes are given. Some anatomical and physiological details have been included in the present edition where they have been considered necessary.

Treatise on Fractures. By John B. Roberts, A.M., M.D., and James A. Kelly, A.M., M.D. Second Edition. Pp. x + 755, with 1081 illustrations. Philadelphia and London: J. B. Lippincott Company. Price 42s. net.

This edition has been entirely reset to incorporate the lessons learned during the War. The early chapters are devoted to the varieties of fractures met with, their symptoms, complications, methods of diagnosis, and general lines of treatment.

In dealing with the operative treatment of fractures, the authors state that in their experience those cases requiring operation are comparatively few. Fractures of the vertebræ and their complications are clearly described; the illustrations, showing the areas of anæsthesia resulting from the various lesions, being particularly helpful. The succeeding chapters are devoted to fractures of the individual bones of the extremities. Paragraphs on anatomy and surface markings are given at the beginning of each chapter, but these err on the side of brevity in some cases.

In the treatment of upper limb fractures, the authors impress the importance of early massage and movement combined with splinting, and while expressing their own views they also give the methods adopted by other authorities.

Considerable space is devoted to fractures of the femur and their treatment, but under the latter heading the method of suspension and extension obtained by the use of Thomas's splint is disposed of in four lines. Obstetric fractures and Industrial and War fractures are dealt with separately.

The illustrations are particularly good, the numerous radiograms especially, adding greatly to the value of the volume.

Traumatic Surgery. By JOHN J. MOORHEAD, M.D., F.A.C.S. Second Edition. Pp. 864. Philadelphia and London: W. B. Saunders Company. 1921. Price 45s.

In this edition numerous changes and additions have been made, and measures employed in military surgery that are applicable to civil practice have been included in the work. The complications that occur with most serious accidents, the question of wound infection and the methods of combating it are first dealt with, the Carrel-Dakin method of wound irrigation being fully described. A valuable section deals with the common infective lesions that occur in relation to the hand.

Under the heading of injuries of joints, appear a number of excellent skiagrams showing the blood supply of the important joints. The various methods of treating infected joints, which were adopted during the War, are given, and the merits of each discussed. Over two hundred pages are devoted to a study of fractures. The descriptions of the bones, the lesions that occur and their symptoms, are given clearly, but briefly. Treatment is dealt with more fully, and the large number of radiograms which illustrate this section are a special feature of the book. The author's preference is for simple, easily removable splints, but he also describes the more complicated apparatus employed. Deformities of the hands and feet are touched on briefly, except in the case of Dupuytren's contraction, which is discussed in considerable

detail. Injuries of the head, spine, chest, and abdomen all receive adequate consideration, more especially as regards treatment. A chapter on traumatic neurosis deals with this subject fully, and other subjects dealt with are burns, eye and ear tests, X-rays, medicolegal phases, and standardized first-aid methods in accidents.

The majority of the illustrations are excellent.

Diseases of the Nervous System. By H. Campbell Thomson, M.D. F.R.C.P. Third Edition. Pp. 566, with 145 illustrations. London: Cassell & Co. 1921. Price 15s. net.

This well-known manual, now appearing in its third edition, retains its original character of a concise and lucid presentment of the main facts of neurology, while including a considerable amount of new material. The added knowledge gained during the War regarding the effects of spinal and cerebral injuries has been utilised in the revision of these subjects, and such recently described conditions as *Encephalitis lethargica* have been introduced with the effect of bringing the book up-to-date. Controversial subjects are treated by presenting a brief statement of the opposing views rather than by a dogmatic adherence to one or other. Clearly printed and well illustrated, the present edition should enhance the book's popularity with both students and practitioners.

Medical Electricity, Röntgen Rays, and Radium, with a practical chapter on Phototherapy. By Sinclair Tousey, M.D. Third Edition. Pp. 1337, with 860 illustrations. Philadelphia and London: W. B. Saunders Company. 1921. Price 50s. net.

To deal adequately with the three subjects of medical electricity, röntgen rays and radium in one volume is an overwhelming task. This edition, with its vast amount of material, will doubtless have its usefulness for purposes of reference, but owing to its size, is not likely to become a popular text-book, or one to be read through page by page. Much would have been gained and nothing lost, had the contents been differently arranged and presented in separate volumes. Although the book does not contain anything outstanding or new, it is nevertheless a carefully indexed compilation of all that is known on the subject. The radiographs generally are disappointing; this being specially the case with regard to the stomach after an opaque meal.

A Manual of Physics. By J. A. Crowther. Second Edition. Pp. xxii + 537, with 295 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price 16s. net.

Crowther's manual of physics is a very elementary text-book for the use of first-year medical students. A large number of books on

physics cater for this class of student, but in most respects that under review is to be commended above many of its order. It has the merit of assuming nothing to begin with, and it attempts to develop the subject systematically. It also has the credit of keeping well in touch with laboratory work, though it wisely refrains from entering into such experimental details as are better learned by handling the actual apparatus. The subject matter is developed in as logical a sequence as the limitations of the student render possible, and although in some chapters the statements that are made are scarcely as accurate as they might be, there is little serious misstatement of any important fact. The book is well arranged and clearly expressed, and it takes a creditable place amongst the text-books of elementary physics.

The Prospective Mother: A Handbook for Women during Pregnancy. By J. Morris Slemons, M.D., Associate Professor of Obstetrics, the Johns Hopkins University. Second Edition. Pp. x + 344. New York and London: D. Appleton & Company, 1921. 5s. net.

The "prospective mother," for whom Professor Slemons writes, is better known on this side of the Atlantic as the "expectant mother," just as "prenatal" in America is more commonly used than "antenatal," as the adjective describing the state before birth. Throughout the whole of this work, which forms an admirable guide to the pregnant woman, the atmosphere, so to speak, is transatlantic; under "miscarriage," for instance, there are frequent references to Maryland law and Colorado law, etc., matters which lose their pungency in this country. Professor Slemons is to be congratulated on the correctness of his account of the introduction first of ether and then of chloroform into midwifery practice by Sir James Y. Simpson, a historical detail not always justly stated even in British text-books; and he is under no misapprehension that "twilight sleep" has its risks. Professor Slemons' book is a safe guide for the pregnant woman, and may heartily be commended.

NOTES ON BOOKS

Critical Microscopy, by Alfred C. Coles (London: J. & A. Churchill, 1921, price 7s. 6d. net). Although for most purposes a medical student picks up in the course of his career sufficient knowledge of the use of the microscope, a desire to know more about the tools he uses is implanted in the minds of a good many workers. To such, and to men who are seriously engaged in histology, Dr Coles' book will prove both attractive and interesting. It is not over-

loaded and covers the ground well, and many will rejoice in the absence of mathematical theory. It is a book the contents of which are not hard to master if they are read with a microscope and some slides at hand, and once mastered they should render their possessor a more competent microscopist.

Sexual Life of Primitive People, by H. Fehlinger, translated by S. Herbert, M.D., and Mrs Herbert (London: A. & C. Black, Ltd., 1921, price 6s. net). This book consists of a brief catalogue-like description of the sex customs of primitive folk. It is the sort of thing that any moderately industrious compiler with access to anthropological literature could easily have produced. The contents are classified under such headings as modesty, premarital relations, courtship, ritual mutilation, and so on. The translators put it forward as an introduction to the sex life of primitive peoples, and it is apparently intended for the edification and instruction of persons who regard the established order of sex relationships and marriage as so self-evident and stable that the law of evolution does not apply to it. If there be any such among its readers, they will, we think, have a good deal of difficulty, unless their ability is above the average, of drawing any conclusions from this book as to the process of evolution of the relations in question. What strikes one most on reading it is the absence of any attempt, save perhaps in connection with exogamy, to draw any general conclusion, or to correlate the facts with civilised customs. Although the book cannot be regarded, therefore, as a very useful work, it is only right to say that the subject is dealt with in a scientific manner, and that it might be read by any boy or girl of an age to understand the importance of sex in the affairs of life.

Physical Diagnosis, by W. D. Rose (Henry Kimpton, 1921, price 45s.), is designed for the student and general practitioner as a guide to the principles of physical diagnosis. There is included a brief survey of the chief physical signs of the commoner diseases of the respiratory, circulatory and nervous systems. The numerous illustrations are excellent and include several very clever diagrams which make clear the mode of production of certain physical signs. In this second edition of the work much of the text has been recast to enable the author to include references to important recent work.

A Text-book of Midwifery, by Kedarnath Das, C.I.E., M.D. (Calcutta: Thacker, Spink & Co., 1921, price Rs. 13/8), is compiled for the use of the students of our Medical Schools and Colleges in India, and it is to be heartily welcomed. The subject-matter is well arranged, and the illustrations, largely drawn from standard works, are good. In his prefatory notice the author aims at presenting a book confined within reasonable compass so as not to overburden the

student, while at the same time presenting a reliable and sufficiently comprehensive text-book. The volume promises to justify his anticipations.

Dr Emmet Holt's *Care and Feeding of Children*, now in its ninth edition (D. Appleton & Co., 1921, 4s. net), is a manual on the catechism plan, adapted for the use of nurses. It is wholly excellent. The introduction by Dr Eric Pritchard stands as it did in 1904.

Mental Hospital Manual, by John Macarthur (Henry Frowde and Hodder & Stoughton, price 15s. net), is a useful text-book, and probably the only one fulfilling the purpose. It is written for medical officers just taking up asylum work, and is essentially practical, well arranged, simple, and easy reading. It deals with all the points of asylum routine which, no matter how well qualified the medical officer may be, he can only learn through many months of experience in the wards, and after having shown a fair amount of ignorance before a specially trained staff. The book makes no attempt to deal with the large subject of mental diseases, and only touches lightly on treatment, but so far as it goes, and for the purpose for which it is written, it is a useful handbook.

The fifth edition of *Anatomy of the Brain and Spinal Cord*, by J. Ryland Whittaker (E. & S. Livingstone, price 12s. 6d. net), shows a certain increase in size, owing to the rewriting and extension of some previous descriptions, but otherwise shows no great alteration from previous editions. As formerly, it presents to the student a clear and concise account of the essential facts in the anatomy of the centrai nervous system, and the present edition will maintain, and probably enhance, the reputation which the book already enjoys. Both terminologies are employed, the B.N.A. perhaps not always with complete success, but in a manner which a student accustomed only to the new will certainly find quite intelligible.

Lippincott's Quick Reference Book, Medicine and Surgery, by George E. Reaberger (J. B. Lippincott Company, price 63s. net), consists of eleven sections dealing respectively with (1) General Medicine and Surgery, including Neurology and Diseases of Children; (2) Gynecology; (3) Genito-Urinary Diseases; (4) Obstetrics; (5) Skin Diseases; (6) Diseases of the Eye; (7) Diseases of the Ear; (8) Diseases of the Nose; (9) Diseases of the Throat; (10) Orthopædics; and (11) Drugs. Diagnostic laboratory tests are supplied where necessary. The therapeutics dealt with will be found extremely useful. Section 11 deals concisely with the drugs used in the body of the work, with their dosage, mode of administration, pharmacological actions, and toxic effects. The work, indeed, covers a wide field of practical medicine, and much of the modern literature is contained therein.

Notes on Books

Notes on Diseases treated by Medical Gymnastics and Massage, by Dr J. Arvedson, Stockholm, translated and edited by Mina L. Dobbie, M.D., B.Ch. (J. & A. Churchill, 8s. 6d. net), has been a standard work on the subject for the past twenty years in Scandinavia. Dr Mina Dobbie has rendered a service by making it accessible to the English-speaking races. Diseases and surgical conditions are classified, and notes given on symptoms and pathological changes, and the method of treatment described. The book does not go into details of technique, for the description of which it is intended that *Kleen's Massage and Medical Gymnastics* should be used. Having been recently revised and brought up to date, and most moderately priced, it is a work that all medical gymnasts should possess.

Mother and Child, by Edward P. Davis (J. B. Lippincott Company, price 12s. 6d. net), is designed to help the family physician in the care of his patients, by placing at their disposal information which he commonly gives to them. The fact that it has reached a fourth edition indicates that there appears to be a demand for a book of this nature.

A synopsis of the preventive measures against communicable disease, arranged in graphic form, is provided by the four *Barrier Charts for Health Officers*, by Dr S. H. Dankes (Baillière, Tindall & Cox, price 3s. 6d. net). The idea is a good one and well carried out, and the charts should prove useful reminders of the principles of prevention of the spread of infectious disease.

A collection of lantern slides illustrating the anatomy of the temporal bone has been prepared by Mr A. H. Cheatle. The set, numbering 200, along with an album, costs £30. Judging from the catalogue (H. K. Lewis & Co., Ltd.), the slides should prove very valuable for teaching and demonstration.

Diseases of the Ear, Nose, and Throat, in Childhood, by Douglas Guthrie, M.D., F.R.C.S. (A. & C. Black, Ltd., price 5s.), only attempts to supply to general practitioners, medical inspectors of schools, and superintendents of child welfare centres some practical information regarding the common diseases of the ear, nose, and throat in early life. It appears to the reviewer that it would appeal rather to nurses and social workers, to whom the author hopes it may be intelligible and helpful. The illustrations are not very good, and there is a certain amount of repetition which might have been avoided. The teaching as regards "colds in the head," and removal of tonsils and adenoids appears on the whole to be sound, though perhaps too much space is taken up by the description of the operative removal of the latter. There is a useful list of prescriptions at the end and also an index.

Notes on Books

The student desirous of revising his materia medica will find what is necessary in Dr Bennett's *Materia Medica and Pharmacy* (H. K. Lewis, 7s. 6d. net).

Diseases of Children, by Herman B. Sheffield, M.D. (Henry Kimpton, price 48s. net), is "designed for the use of students and practitioners," but after a careful examination we are unable to recommend it as a safe guide to the subject it deals with. For example, Fig. 162, p. 563, is described as "Hypothyroidism—Myxidiocy, in a girl 16 years old." But the facies of this child is not that of a cretin. Fig. 215, p. 720, is described as "Mongolian idiot of 23 months, Calmuck type." Our view of this photograph is that it is certainly not that of a mongol baby, but might be one of a cretin. Fig. 216, p. 722, has the legend, "Cretin from birth, total idiot. Note 'trident hand.'" But the facies and the hand in this photograph are typical of a mongol and not of a cretin. We have also the gravest doubt as to the author's interpretation of Figs. 217 to 220 as a case of cretinism. The book, as a whole, gives a presentation of the subject that it is careless, incomplete, and sometimes seriously erroneous.

Clinical Examination of the Nervous System, by Dr Monrad-Krohn (London, H. K. Lewis & Co., 1921, 6s. net) gives clearly the clinical tests which the author has found of most value, and lays down a definite routine method of examination which the young neurologist will find of the utmost value.

Tuberculosis: Its Prevention and Home Treatment, by H. Hyslop Thomson, M.D., D.P.H. (Henry Frowde and Hodder & Stoughton). It is generally realised that the treatment of tuberculosis is an expensive procedure. Much can be done in the patient's home, provided the patient has been well trained in fundamental principles, and has the will to "make good." To those patients who can carry out home treatment in a satisfactory manner there is much useful information in this small book, which explains in simple language the why and wherefore of the medical attendant's advice and instructions.

Practical Tuberculosis, by Herbert F. Gammons, M.D. (Henry Kimpton, 1921, price 10s. 6d. net) aims at giving advice in pulmonary tuberculosis along broad lines only. As it is addressed to general physicians more particularly, the practical issues one has to meet in daily practice are kept to the fore. The importance of early diagnosis and the dangers of waiting for a "positive sputum" are duly mentioned. A return to the physiological life, under specialist supervision, is insisted on as the only adequate procedure to secure a successful result. The value of drugs is correctly estimated. The author is not in favour of vaccines in the treatment of the mixed infections of tuberculosis; he is convinced that tuberculin treatment cannot

be carried out by the general practitioner alone, but he does not give any clear statement as to his view of its value. There are no detailed directions as to treatment, diet, etc. The style is short and abrupt.

Operative Dental Surgery, by J. B. Parfitt, L.R C.P., M.R.C.S., L.D.S. (Edward Arnold & Co., price 21s. net), originally compiled for a course of lectures, and now elaborated into book form, provides an excellent treatise on most of the everyday work of the dental practitioner. The author has intentionally omitted bridgework, orthodontics, and prosthetic dentistry. There is much useful information on the more generally accepted methods, and as it is written in a lucid style, well printed, and profusely illustrated with up-to-date diagrams, it should prove a useful text-book to the student and book of reference to the operator of limited experience. The chapters on ionic medication and nerve blocking will interest those who have not yet added these methods of treatment to their technique. The author is to be commended on the stress which he lays on the aseptic and antiseptic precautions which dentists should observe in their work and surroundings.

Dental Registration, by Sir Kingsley Wood, M.P. (Baillière, Tindall & Cox, price 5s.) is a useful practical guide to the Dentists' Act of 1921.

Dr A. S. Herbert's *Hot Springs of New Zealand* (H. K. Lewis & Co., Ltd., price 15s. net) provides a well-written, well-illustrated and valuable guide to the thermal waters of New Zealand and their therapeutic uses.

TRANSACTIONS, REPORTS, ETC.

Transactions of the American Urological Association, 1920 (Williams & Wilkins Company, 1921). In his Presidential Address on "Some Hypotheses regarding Renal Tuberculosis," Dr Arthur L. Chute contends that if we accept the hematogenous origin of the infection in renal tuberculosis we must assume that tubercle bacilli are brought in approximately equal numbers to both kidneys; that little cortical tuberculous infections are common, and that, far from going on to the complete destruction of every kidney that is infected, they are probably promptly stamped out in by far the great majority of instances, and only where local injury or similar agent lowers the power of resistance does the tuberculous process become definitely established. Eisendrath, in a paper on "The Relation of Variations in the Renal Vessels to Pyelotomy and Nephrectomy," demonstrates the great frequency with which abnormal blood vessels are met with. The presence of accessory superior polar arteries, and the fact that the main renal artery may divide into pre- and retro-pelvic branches of equal size is emphasised.

The Transactions also contain twenty-three other articles, with a report of the discussion to which they gave rise.

The Transactions of the American Association of Genito-Urinary Surgeons, 1920 (Williams & Wilkins Company) contains the Communications given at the meeting of this Society held in the Mayo Clinic in June 1920. The papers are followed by an abstract of the discussion to which they gave rise, and are full of interest.

The latest addition to periodical medical literature is the *Journal of the Philippine Islands Medical Association*, of which the first number has just come to hand. It is well got up, and a credit to the medicine of the far east, or, should we say, west.

The Transactions of the College of Physicians of Philadelphia (3rd series, vol. xli., Philadelphia, 1919) has just reached us. It contains a number of interesting papers, many of them dealing with medical questions arising out of the war.

The first number of the new *International Journal of Gastro-enterology* has been sent to us (220 West 59th Street, New York, $6.00 per annum). The Editor has adopted what is to us an original notion, namely, to submit original articles to well-known experts for commentary, and to publish the commentaries after the articles. From his Editorial Note we gather that he has not lain on a bed of roses during the birth of the first number of his journal. There would seem to be a place for a journal of this scope, and the results of the venture will be awaited with interest.

BOOKS RECEIVED

Dunning, William Meddaugh. Submucous Resection of the Nasal Septum	(*Surgery Publishing Co.*)	
Fischer, Martin H. Soaps and Proteins . .	(*Chapman & Hall*)	24s.
Garrison, Fielding H. An Introduction to the History of Medicine. Third Edition	(*W. B. Saunders Company, Ltd.*)	45s.
Ker, Claude Buchanan. A Manual of Fevers. Second Edition	(*Oxford Medical Publications*)	12s. 6d.
Lunacy and Mental Deficiency. Seventh Annual Report of the Board of Control. 1920		
McCann, Frederick John. The Treatment of Common Female Ailments	(*Edward Arnold & Co.*)	8s. 6d.
Mellish, Mrs M. H., Edited by. The Collected Papers of the Mayo Clinic	(*W. B. Saunders Co., Ltd.*) Vol. XII., 1920	60s.
Merck, E. Jahresberichte. 1919-1920. Jahrg. XXXIII. u. XXXIV.	(*E. Koether, Darmstadt*)	
Rockefeller Foundation. Annual Report. 1920		
Shaw, H. Batty. Hyperpiesia and Hyperpiesis	(*Oxford Medical Publications*)	21s.
Shuttleworth, G. E., and W. A. Potts. Mentally Deficient Children. Fifth Edition	(*H. K. Lewis & Co., Ltd.*)	10s. 6d.

Edinburgh Medical Journal

April 1922

ON PUBERAL MAMMARY HYPERTROPHY.*

By DAVID M. GREIG, C.M., F.R.C.S.E., Conservator of the Museum of the Royal College of Surgeons, Edinburgh.

THE ultimate function of biogenesis, the consummation of the evolutionary cycle, the *raison d'être* of existence, being the propagation of the species, whether of plants or of animals, it is little wonder that throughout all ages, the essential organs of generation have received special attention, and of this the organ of lactation has received its share. The variations of the female breast, its diseases, and its relation to child-rearing have been subjects of observation through all time, and, since the introduction of language, doubtless of comment. Even in modern times the mamma is viewed only from the utilitarian standpoint, æstheticism perforce reconciling itself, and any extreme variation of the organ is resented by the individual and regretted by her sex. But when such variation imperils life, resentment and regret are replaced by horror. Fortunately such conditions are rare—they could not be otherwise—and one of these rarities I propose to epitomise in this lecture. As a text I shall take a case which came under my own observation.

Two years ago I was asked by Dr W. B. Drummond to see a mentally-deficient female, aged 14½ years, who had been an inmate of Baldovan Institution since January 1915. She was the subject of spastic diplegia, unable to speak, though perhaps understanding a little of what was said to her. From the contracture and rigidity of her limbs she was unable to walk or stand. Apart from her paralysis, her general physical development was fair. She was of good colour, had a fresh complexion and soft, delicate skin. Her teeth were good, and there was nothing in her appearance to suggest inherited syphilis, nevertheless her Wassermann reaction was positive, though

* A lecture delivered to the Fellows at the Royal College of Surgeons, Edinburgh.

when the examination was made the serum itself was somewhat anti-hæmolytic.

Though requiring to be fed, she took her food well. The undeveloped musculature of the limbs, and of the body generally, gave her perhaps a spare appearance. There was not, and never had been, any tendency to adiposity. The breasts had never been unduly developed, and previous to puberty conformed to the usual infantile type. With the earliest signs of puberty some five months previously, the breasts had shown some fullness; but it was not until two months later, when she menstruated for the first time, that any unusual increase in the size of the breasts took place and that hypertrophy could be said to have begun. She had not menstruated again, but the enlargement of the breasts had rapidly increased, though varying a little from time to time. Undoubtedly the breasts were tender, and, according to Dr Drummond, more so at some times than at others. They did not appear to give her pain, however, except when touched. Their size and weight suggested discomfort had she been able to go about, but sitting in a chair or resting in bed, there was no appearance of suffering.

Recumbent, the hypertrophied breasts overflowed the thorax; while sitting in her chair, they appeared inadequately supported by the abdominal wall, and in certain positions they rested on the flexed thighs. The breasts were of dusky complexion from congestion and venous engorgement, and there was some redness of the skin. The superficial veins were excessively distinct. The nipples were small, and each lay in a hollow formed by the projection of the parts around, not by their own retraction. Each areola was increased in extent and deepened in pigmentation. The areola of the right breast measured three inches, that of the left two inches in diameter. The enlargement of the breasts was not uniform as from the deposition of fat, but unequally, as in lactating breasts, when, with physiological activity, the gland-lobules have undergone enlargement, irrespective of the tissues in which they are embedded. Thus the contour of the right breast was regular and of normal shape towards the axilla, while in the most dependent part it had become flattened, with a rounded projection at the sternal, as at the axillary limit of the breast. The left breast was the larger and had a similar irregularity of contour, but this was accentuated by a prominent area extending medially from the mammilla upwards to the manubrium sterni. This raised area was even more dusky than the adjacent breast-surface, and presented a distinct capillary telangiectasis of the integument. It gave a semi-fluctuant sensation, and this suggestion of suppurative inflammation was accentuated by the rise of temperature in the skin, consequent on its increased blood-supply. Except for a few sparse black hairs on the mons veneris, the external genitals retained their infantile characteristics.

The photograph gives but an imperfect idea of the size of the breasts relative to the rest of the body, as the paralytic rigidity made it impossible to have the child sitting up properly, and the semi-reclining attitude has introduced the inevitable photographic errors in perspective. The monochrome, too, eliminates the discoloration which was such a striking feature of the enlarged parts, nor does it demonstrate the blue reticulation of the dilated cutaneous veins which was so obvious. The very intensity of the congestion suggested deterioration in vitality.

The defective nutrition and the venous engorgement combined to bring about the dreaded result sooner than was expected. Within a month a small sinuous line of what appeared to be subepithelial suppuration appeared in the upper quadrant of the left breast, extended upwards from the areola, and coincident with this the temperature rose to 103° F. Support was given and suitable dressing applied, but a dusky red flush, which had overspread the left breast, now appeared on the right, and at the same time, the engorgement of cutaneous veins increasing, suggested stasis. There was no abscess formation during the week she survived, but rather a necrosis of tissue, in which suppuration played a minor part, though the septic infection produced the systemic disturbance and brought about the septicæmia of which she died. At no time did the local or her general condition warrant amputation.

At the post-mortem examination, exclusive of those conditions directly resulting from the congenital affection of the central nervous system, the organs, apart from the breasts, were healthy. The ovaries and uterus were normal for a child of her age at the time of puberty, that is to say, they had not entirely lost their infantile characters. There was no overgrowth. The spleen was enlarged and diffluent, as in prolonged pyrexia; the kidneys congested; and the heart was of that flabby type found in persons whose congenital defects have precluded muscular exercise. During the last few days of life the breasts had undergone some diminution, yet the left breast measured eight inches vertically by eleven horizontally. The upper quadrant of the left breast exhibited a circular superficial slough five inches in diameter, and section of that mamma showed that burrowing of pus had taken place, but to a less extent than might have been expected from the profoundness of the systemic disturbance.

The right breast (the smaller) was removed for pathological examination, and on this Professor L. R. Sutherland reported:— "Weight, 700 grammes.* To the naked eye the condition seemed unusual. Seems to be generalised hypertrophy, with glandular hyperplasia in nodular form. General appearance suggests benign

* The normal adult female breast weighs 160 to 556 grammes.

lesion. Microscopical examination showed the structure mainly fibrous, with gland spaces filled with altered epithelium, marked orange brown. Sections stained by Gramme's method gave negative results." Professor Sutherland pointed out to me that the peculiar shedding of the epithelium into the gland spaces and ducts was such as is found in some cases of great glandular activity. The distension so produced, together with the decided glandular hyperplasia, brought about a sort of nodular formation of gland tissue, suggestive of, but in no way of the nature of, adenomata.

Hypertrophy of the breasts is so arresting and impressive an occurrence that few cases can escape being reported, yet I have been able to verify but twenty-six which appear to me to be undoubtedly of the puberal variety. Some of these are mentioned in Deaver and M'Farland's table,[11] but from this table I would also admit twenty cases which, though I have not been able to verify them, appear to justify inclusion.

The term "puberal" applied to this form of hypertrophy of the breasts deserves approval, because it is descriptive, and because it emphasises that relationship between the overgrowth and the incidence of menstruation, which is such a striking feature. On the other hand "virginal hypertrophy" is too exclusive, as the disease may be in association with unchastity; and "diffuse hypertrophy" is not exclusive enough of what is particularly, and may be entirely, a glandular affection. In a recent paper Keyser[30] uses the term "massive hypertrophies of the breast," and by this he can, and does, include enlargements which are in no way related to the puberal. As I hope to show, the etiology, the signs and symptoms, the prognosis, and the treatment, unite to mark puberal hypertrophy with specific differences which distinguish it from other forms of enlargement or disease.

Hypertrophy other than puberal may occur in either sex with general obesity,[1] and there is a probability of some of these cases being associated with hypopituitarism. Large, voluminous breasts[3] may be an individual peculiarity or may be hereditary. The most pronounced cases are for the most part entirely fatty. I recollect a case of this sort where the enlargement, commencing at puberty, attained unusual size. Subsequently she married and had three children but the breasts were functionally useless. In one of Keyser's cases,[30] a girl, aged 19, the enlarged breasts, amputated at the girl's insistence for æsthetic reasons only, were found to be entirely fatty.

Exclusion must also be made of cases where the gradual permanent enlargement was co-incident with the stimulation of repeated pregnancies. Apart from pregnancy too, and not confined to nulliparae, slow progressive enlargement suggests a chronic mastitis. Two of Keyser's cases appear to be of this nature. One, a married woman, aged 36, with whose only pregnancy, five years previously, the enlargement had begun, had the breasts amputated on account of weight, and examination suggested a chronic interstitial mastitis; while another, a woman aged 41, the mother of three children, the youngest being twelve years of age, had her breasts removed for the same reason and they were found to be "mostly fatty." It is obvious that though these could be included under such a term as "hypertrophy," or even under the more exclusive one of "massive hypertrophy," they are not of the puberal variety. Chronic enlargement always suggests a local cause, particularly if the enlargement be unilateral. One looks askance at unilateral cases included in the list of puberal hypertrophies, for it is obvious that the stimulation to mammary growth, other than local, must have a systemic distribution, and therefore cannot have its influence limited to one breast only.

Puberal hypertrophy, probably always the same pathological divergence from the physiological normal, admits of division into puberal and puerperal, for in still rarer cases the stimulation of pregnancy produces the same abnormal reaction as the stimulation of puberty. Thus in the subjoined table, adding my case and the one recently reported by Keyser, as well as the twenty unverified ones from Deaver and M'Farland's table, there is a list of forty-seven individuals. Of these, thirty-four were virgins, five were of doubtful chastity, six were nulliparous and pregnant, and two were multiparous and pregnant. The age of the virgins was from 11 to 23 years, an average of about 19. The average age of those of doubtful chastity was 24 years; of those pregnant for the first time, 26 years; and of the pregnant multiparous women, 36 years. A sympathy between the breast and the womb has been recognised from time immemorial, but recent advances in physiology have made this inter-relation more comprehensible. Williams[4] only repeated a generally accepted opinion when he wrote that the chief factor of puberal mammary hypertrophy lay in the pelvic genitalia. He and others have noted that the overgrowth was almost always co-incident with amenorrhœa, whether pathological or physiological.

The oldest record I have been able to verify is that of Durston,[5] who, in 1669, reported from Plymouth, by letter to "my Lord Brounker," the then President of the Royal Society, the case of Elizabeth Trevers, aged 23 years. This person, "fair of complexion, brown-haired, of an healthy constitution, low of stature, of honest repute, but of mean and poor parentage," was alleged to have wakened one morning to find her breasts so enlarged that she could neither turn nor sit up in bed. The assertion of such a sudden onset must, I think, be received with reservation. The tendency of persons possessing something marvellous to supplement the marvel by unveracious detail is well known. Menstruation had been absent about six months. Within two months of the onset of the hypertrophy ulcers formed on the breasts, and a month later she died. The left breast was the larger and weighed 64 lb., and measured 3 ft. 4½ ins. in circumference. "Upon opening it," runs the report, "we could find neither Water, nor Cancerous humors, nor anything vitious, more than the prodigious bigness; and the Tubuli and Parenchymatous flesh were purely white and solid, and no other than what we see in the soundest breasts of women, or the best udders of other animals." The body was emaciated. Further examination was refused by the Aunt. And Durston writes, "I was sufficiently troubled to be thus disappointed by a fond extravagant woman," an echo of which may be heard in the post-mortem room even to this day. An excellent engraving accompanies the report.

Though the overgrowth be undoubtedly puberal its appearance may precede the onset of menstruation, as in a case reported by Hutchinson,[6] or menstruation may have happened on one or two antecedent occasions. Again, menstruation may have become fully established; but is generally in abeyance when hypertrophy sets in. In cases not strictly puberal, pregnancy evidently supplies the stimulus, as in the cases reported by Billroth[7] and Simpson,[8] the former that of a primipara aged 22, the latter that of a primipara aged 32. In both women, previous fullness of the breasts had been observed before the actual hypertrophy had begun in the early weeks of the first pregnancy. In both cases the cause of death was septicæmia following ulceration. In Simpson's case there was no necropsy. Billroth's patient aborted twenty-four hours before death. Billroth examined the breasts and reported that it was not a pure hyperplasia. "The cross-section of the mamma resembled

that of a uterus studded with numerous fibromata, but the tumours were softer and contained more juice than ordinary uterine fibrous growths." It is a permissible suggestion that as true fibromata, as now understood by pathologists, are so exceedingly rare in the breast as to be practically unknown, the peculiar nodular condition which was so obvious in my patient might explain the "fibromata of various consistency;" while if Billroth meant what we now know as fibro-adenomata, the rate of growth is incompatible with that diagnosis. This "nodulation" is almost invariably mentioned by surgeons, and may be accepted as fairly constant and characteristic. Rohloff, cited by Deaver and M'Farland,[11] in recording his case in a girl aged 21, from whom both breasts were amputated six months after the commencement of the hypertrophy, expressed surprise that on section the nodes which he had so distinctly felt were indeed part of the hypertrophy, and that there were no tumours. Licene and Lenormant[29] figure Manec's patient, a virgin aged 17, and call the condition "Hypertrophie mammaire bilaterale," but by adding, in brackets, "adenome acineux diffus," seem to me to overlook the puberal element in the causation. Again Honan[9] writes of his patient, "The consistency (of the breasts) was soft, except that numerous firm nodules were to be felt scattered throughout the organ, suggesting the presence of multiple fibro-adenomata," and one wonders if this "suggestion" did not bias his pathological report, for this patient was but 16 years old and the hypertrophy had existed two years. It is not inconceivable that one or more adenomata might be present in a breast affected with puberal hypertrophy, but they are accidents, and the hypertrophy is in no way dependent on them. There seems no doubt they were present in Keyser's patient,[30] and perhaps there being several in the right, and only one in the left breast, may account for the right being the larger, an anomaly in puberal hypertrophy. The right breast may have been the larger before the puberal overgrowth set in. Only in the ultra-acute is the duration of the hypertrophy to be measured by weeks, the average duration before operation or death working out at about eighteen months.

In M'Gavin's case[10] of puerperal hypertrophy in a primipara aged 25, some permanent enlargement of the left breast had followed the removal of an adenoma two years previous to marriage. Hypertrophy began in the second month of her pregnancy, and the description of the mammæ at the fourth

month that they were much enlarged, "accompanied by diffuse inflammation, were hot, red, tender, dusky, nodular, long and pendulous," leaves no doubt as to the diagnosis. At this time the patient came under the care of Mr Douglas Drew, to whom I am indebted for the further information that he induced a miscarriage, and three weeks later amputated the one, and three weeks later amputated the other, and that the patient then made a satisfactory recovery.

Deaver and M'Farland's table[11] already mentioned is often erroneously referred to as a table of 240 *cases*. It thus produces an altogether misleading impression as to the frequency of incidence of puberal hypertrophy, for even as a table of reference it requires much emendation. For instance, in no less than fifty-one of these references no new case is recorded; with forty-eight I deal in the present paper; while only other twenty justify consideration as probable examples of puberal hypertrophy. Indeed, all the "comprehensive" literature on the subject requires revision. To appraise rightly puberal hypertrophy, extraneous cases must be excluded. A temperate and useful résumé is given by Marmaduke Shield,[20] and his warning in doubtful cases only to accept them after modern pathological examination is significant. He adds two cases to the literature—Maitland's and Jower's.

It will be necessary to consider briefly some of the generally accepted cases which appear to me to have been wrongly classed with puberal hypertrophy. Thus a frequently referred to case is that of Sir Astley Cooper's,[13] but that was an affection of only one, the left breast. The girl was 15 years of age, and the breast after removal weighed 14 lb. 10 oz.; but unless the other breast was proved functionally incapable of enlargement, the case ought not to be accepted among the puberal hypertrophies.[26] Certainly one, and probably both of Aitken's cases[14] were of acute carcinoma, and I only mention them here because he noted that after death "the skin covering them (the mammæ) was less tense than before death, probably from gravitation of the blood towards the dorsal regions of the body," an occurrence one might expect to find in every mammary engorgement when the cadaver lies supine, and which was so evident in my case.

Birkett[15] quotes an observation made by Fingerhuth in 1837 of a girl, aged 17, whose breasts had enlarged during a year but more rapidly in the last two months. The right

PUBERAL MAMMARY HYPERTROPHY

was the larger. Both were soft, not tense nor painful, and they improved under treatment until they became normal. It seems stretching possibilities to include this as puberal hypertrophy. Velpeau,[16] who does not appear to have had any personal experience of puberal hypertrophy, states that if the glandular tissue alone is affected, the breast is dragged down by its own weight, elongates and soon becomes pendulous. In this connection it seems doubtful if Thomson's case, which Birkett figures, was really one of puberal hypertrophy from the way in which the breasts stand out from and are supported by the chest. Nor is the illustration in accordance with the text, for the left breast is pictured as full and projecting, while the description records it as "flabby," and the right as "very painful, particularly when handled," and three times the size of the left. But if these points were not sufficient to rule this case out from the puberal hypertrophies, there remains the fact that the patient became "quite well" in three weeks after the passage of a seton "down to the gland itself." Now puberal hypertrophy seems to give little disturbance other than from its weight unless some septic process sets in; yet Thomson inflicted a deep septic trauma, which was followed by rapid recovery. How much more like an inflammatory condition than like a true hypertrophy! In Huston's patient (quoted by Williams[12]), a trivial blow during exercise in a girl, aged 16, who, though the subject of puberal hypertrophy, was able for healthy activity, was quickly followed by a necrosis of tissue, septicæmia, and death.

The case recorded by Beatson[17] in the *Edinburgh Medical Journal* for 1908 does not belong to this category either, the enlargement being mostly due to fatty deposition; and when he states that "hypertrophy of the female mammæ runs a chronic course extending over years," it is obvious that he refers to such cases as he there reports, and not to puberal hypertrophy or its puerperal congener, for in both of these the feature is, *not* chronicity, but rapidity and fatality. Neither the history nor the appearances justifies the inclusion of Proctor's case[18] with puberal hypertrophies, and Burton's[19] is too loosely reported to be of any value.

Williams[12] points out that the normal increase of the female breast at puberty is due "even more to the overgrowth of its fibro-fatty envelope than to the glandular ectasia," whereas, during pregnancy, the increase in size is almost entirely due

to the physiological overgrowth of the glandular parenchyma, and puberal hypertrophy conforms with the latter more than with the former changes. In physiological enlargement the stimulant is doubtless an hormonic autacoid, but in the pathological overgrowth there is a suggestion of want of control of the process started. The mammary changes may be advanced, yet the ovaries and uterus may retain most of their infantile attributes. Nor can it be deduced that, because my patient had an affection of the central nervous system, the cause of puberal hypertrophy lay there, for in none of the other cases recorded did the patient show symptoms of cerebral or nervous disease.

It may not be out of place here to recall the observation of Jacobson,[21] that in destruction of the testicles in young adults the most striking feature is enlargement of the breasts. This enlargement is sometimes due to fat, as in age, but sometimes to "a real hypertrophy of the glands," as at puberty, and he quotes a case of Lereboullet's, where after complete atrophy of both testicles following mumps in a young man, aged 22, "the breasts were voluminous, and hypertrophied lobes and the granular feel of the breast-tissue were easily made out." But after all this bears more on the physiology than the pathology of the breast. A perusal of the cases of puberal hypertrophy shows, that though both breasts are always affected they may not be equally so, and that the left is generally the larger.

The appended table shows the almost invariable success attending amputation, if the significance of the hypertrophy be early enough appreciated, and it brings out the danger of a wait-and-see policy. Corroboration is obtained from Deaver and M'Farland's twenty unverified cases I am willing to approve, for each of these patients had her breasts removed and all recovered.

In five cases an interval of from one week to six months was allowed to elapse between the removal of the breasts. In the three who were pregnant at the time, no disturbance to gestation was experienced. In Bryant's case,[22] Sir William Fergusson amputated the breasts at a three-months' interval, and undoubtedly in pre-antiseptic days this would be the safer plan. Rapid improvement in health seems to be the rule after removal of the overgrown organs. Should there be a considerable difference in the degree of affection of the breasts, removal of only one, the larger, seems justifiable, because in some of the

few cases in which this has been done, the remaining breast has diminished in size. Thus, in Hey's case,[23] diminution in size occurred of the right breast after removal of the larger (left) breast. Nine years later the remaining breast was larger than usual, but loose, wrinkled, and atrophied, and doubtless functionless. In Maitland's case, which Shield[20] contributes and figures, the remaining breast was "less than three-fourths of its original size" a week or two after amputation of the larger, and this Maitland attributed to interference with its blood supply by the first operation. But may it not also suggest that the hormonic autacoid may come from the essential breast-cells, and not be dependent on either ovaries or uterus for the continuance of its action?

Whilst in no way advocating abstention from operation once the condition has been recognised, there seems some reason to believe that resolution may take place without operative interference.[25] One would not cite such a case as Adam's reported by Birkett,[15] because, though it seems typical enough of puberal hypertrophy, it was lost sight of and the event is unknown; but Benôit and Monteil report[24] a relevant case. It was that of a virgin, in whom enlargement of the breasts began at 14½ years and reached its maximum at 16 years of age. The breasts were then supported on the thighs and their weight had curved the spine and displaced the scapulæ. The left breast was the larger. Operation was advised and refused. No increase in size took place—doubtless some diminution—during the next eight years. At the age of 24 she married. She had three children, but pregnancy did not affect the breasts, which were functionless. They diminished in size to one half, and, supported on corsets, gave the appearance of a very full-breasted woman, though in reality they were an immense mass of wrinkled and flaccid skin, traversed by enormous varicose or dilated blood-vessels. Apparently the inherent power for further activity had been exhausted, for pregnancy produced no physiological reaction, and the functionally useless breasts continued steadily to atrophy. Diminution in size, suggesting that natural resolution was in progress, was present in the first case reported by Billroth,[7] but the event in that case too remains uncertain, for her subsequent history is not referred to. It is to be noted, however, than neither in Billroth's patient nor in the case reported by Benôit and Monteil was the hypertrophy associated with pregnancy.

Table of Cases of Puberal Mammary Hypertrophy.

Author.	Age.	Virgin.	Nullipara.	Multipara.	Pregnant.	Age at Onset of Menstruation.	Duration of Hypertrophy.	Pathological Report.			Treatment.	Result.	Remarks.	Year.
								Ducts.	Glands.	Stroma.				
Manec (4) .	17	1	...	...	...	?	?	Enormously dilated	...	...	Amputation	Recovery	...	1859
Crofford (4).	15	1	...	...	...	14	1	Filled with hyperplastic cell elements	Sparse	Fibrous tissue hyperplasia; devoid of fat	Amputation	Recovery	...	1891
Labbé (4) .	14	1	...	...	...	12	8/12	...	...	Overgrowth of fibrous tissue	Amputation	Recovery	...	1891
Le Double (4)	15	...	1	..	...	14	6/12	Dilated	Hypertrophied	Overgrowth of connective tissue	Amputation (right)	Improved	Left diminished	1875
Desenne (4) .	15	...	1	...	...	14	1	Dilated	Hypertrophied	Increased fibrous tissue	Amputation	Recovery	...	1886
Bryant (22) .	19	1	...	...	...	?	1 and 6/12	...	Increased	Great increase of fibrous tissue	Amputation	Recovery	...	1887
Robert and Amusat (4)	19	?	1	...	...	18	...	...	Excessively hypertrophied	Overgrowth of fat	Amputation 2 years later	Recovery	...	1851
Hey (23). .	14	1	.	...	...	12	2	No pathological examination			Amputation (left)	Improved	Right diminished	1814
MacSwiney (25)	20	1	...	.	...	14	1	Do.	do.		Amputation (right)	Improved	Left diminished	1869
Benôit and Monteil (4)	16	1	...	...	...	14	1 and 6/12	Do.	do.		...	Improved	...	1877

David M. Greig

Hutchinson (6)	15	1	...	...	...	...	2	...	Hypertrophied	Hypertrophied fibrous tissue	Amputation	Recovery	...	1897
Billroth (7) .	16	1	...	...	...	14	3/12	No pathological examination			...	Improved ?	...	1880
Huston (12).	16	1	...	...	...	14	2	"Mere hypertrophy unconnected with structural disease" (Ovaries larger than usual ?)			...	Died	Septicæmia	1834
Durston (5) .	23	1	...	...	...	?	3/12	No pathological examination			...	Died	Septicæmia	1669
Porter (4) .	37	...	...	1	1	?	3	Do. do.			Amputation	Died	"Collapse"	1892
Billroth (7) .	22	...	1	...	1	15	3	...	Large closely packed acini	Comparatively little	...	Died	Septicæmia	1880
Skuhersky (4)	26	...	1	...	1	?	5/12	Dilated	...	Increase of interlobular fibrous tissue	...	Died	...	1841
Simpson (8).	32	...	1	...	1	16	4/12	No pathological examination			...	Died	Septicæmia	1920
M'Gavin (10)	25	...	1	...	1	?	2/12	Do. do.			Amputation	Recovery	...	1921
Honan (9) .	16	1	...	...	...	13	2	"Structure similar to that of fibro-adenomata with a small amount of cellular infiltration in the neighbourhood of the gland acini"			Amputation	Recovery	...	1920
Maitland (20)	17	1	...	...	...	?	?	"Chiefly fat and fibrous tissue"			Amputation	Recovery	...	1892
Jowers (20) .	15	1	...	...	...	?	?	"Simple hypertrophy"			Amputation	Recovery	...	1898
Adams (15) .	18	1	...	...	...	16	2	.....			...	Lost sight of	...	1849
Carless (27) .	16	1	...	...	...	14	2	Hypertrophy with absence of fat			Amputation	Recovery	...	1896
Johnston (28)	16	1	...	...	...	?	4	.....			Amputation	Recovery	...	1903
Keyser (30) .	15	1	...	...	...	14	1	Fibro-epithelial hypertrophy with absence of fat and the presence of a few adenomata			Amputation	Recovery	...	1921

That which at puberty initiates the changes in the ovaries and uterus towards functional activity, may not lie in these organs themselves, and physiological enlargement may be coincident with, but not dependent on, these changes. That the pituitary influences the sexual glands is common knowledge, and in this relation are also to be remembered the enlargement of the suprarenals during pregnancy, and the atrophy of the pineal gland at puberty. In each, an influence outwith the organ itself is suggested, which brings about physiological processes. When, by pathological overgrowth, the mammary activity becomes exhausted, there may appear the paradox of breasts which are senile, in association with ovaries and uterus in the prime of activity. It cannot fail to be of physiological interest that the hormone of puberal hypertrophy is not a galactagogue; thus adding to the evidence that the galactagogue hormone is only present at the end of pregnancy or after parturition, no matter how large the breasts may be or how active they appear.

Finally, I would emphasise the purpose of this communication, which is, that puberal mammary hypertrophy with its fulminating puerperal congener be recognised as a disease *sui generis*, having distinctive symptoms and running a definite course, and urgently necessitating a definite surgical procedure.

REFERENCES.—[1] Hutchinson, J., *Archives of Surgery*, vol. vi., p. 155, London, 1895. [2] Hutchinson, J., *op. cit.*, vol. iii., p. 327, London, 1891. [3] Hutchinson, J., *op. cit.*, vol. vii., p. 380, London, 1896. [4] Williams, W. R., *Diseases of the Breast*, p. 97, London, 1894. [5] Durston, W., *Philosoph. Trans. of Roy. Soc. Lond.*, vol. iv., p. 1047, London, 1669. [6] Hutchinson, J., *op. cit.*, vol. viii., p. 32, London, 1897. [7] Billroth, Th., *Clinical Surgery*, p. 207 (*Trans. New Sydenham Soc.*, vol. xciv., London, 1881). [8] Simpson, B. S., "Notes on a Case of Diffuse Hypertrophy of the Breasts," *Edin. Med. Journ.*, vol. xxiv., p. 176, Edinburgh, 1920. [9] Honan, P. F., "Note on a Case of Gigantism of Breasts," *Dub. Journ. Med. Sc.*, June 1920. [10] M'Gavin, L. H., "Case of Diffuse Hypertrophy of the Breasts," *Proc. Roy. Soc. Med.* (Clin. Sect.), vol. xiv., p. 21, London, 1921. [11] Deaver, J. B., and M'Farland, J., *The Breast: its Anomalies, its Diseases, and their Treatment*, London, 1918. [12] Williams, W. R., *op. cit.*, p. 11. [13] Cooper, Sir A. P., *Diseases of the Breast*, pt. 1, p. 67, London, 1829. [14] Aitken, W., "On Malignant Glandular Tumours or Hypertrophies of the Mamma in the Female," *Med. Times and Gaz.*, n.s., vol. xv., p. 359, London, 1857. [15] Birkett, J., *Diseases of the Breast*, p. 122, London, 1850. [16] Velpeau, A., *Diseases of the Breast*, p. 177 (*Trans. Sydenham Soc.*), London, 1856. [17] Beatson, Sir G. T., "Hypertrophy of the Female Mamma," *Edin. Med. Journ.*, n.s., vol. i., p. 524, Edinburgh, 1908. [18] Proctor, S. F., "Hypertrophy of the Breast," *Brit. Med. Journ.*, vol. ii., p. 456, London, 1883. [19] Burton, E. J., "Hyper-

trophy of Mammæ," *Liverp. Med. Chi. Journ.*, vol. xii., p. 138, Liverpool, 1892. [20] Shield, A. M., *Diseases of the Breast*, p. 30, London, 1898. [21] Jacobson, W. H. A., *The Diseases of the Male Organs of Generation*, p. 451, London, 1893. [22] Bryant, T., *Diseases of the Breast*, p. 16, London, 1887. [23] Hey, W., *Practical Observations in Surgery*, 3rd ed., p. 500, London, 1814. [24] Benôit and Monteil, *Med. Times and Gaz.* (extract), London, 23rd November 1878. [25] MacSwiney, S. W., "Diffuse Hypertrophy of Both Mammæ," *Dub. Quart. Journ. Med. Sc.*, vol. xlviii., p. 500, Dublin, 1869. [26] Cooper, Sir A., *Lectures on the Principles and Practice of Surgery*, vol. ii., p. 219, London, 1825. [27] Carless, A., "Diffuse Hypertrophy of both Mammæ, *Med. Press and Circ.*, vol. cxiii., p. 343, London, 1896. [28] Kelly, H. A., and Noble, C. P., *Gynecology and Abdominal Surgery*, vol. ii., p. 197, Philadelphia, 1908. [29] Licene, P., and Lenormant, Ch., *Précis de Pathologie Chirurgicale*, t. iii., p. 56, Paris, 1920. [30] Keyser, L. D., "Massive Hypertrophy of the Breast," *Surg. Gynec. and Obst.*, vol. xxxiii., p. 607, Chicago, 1921.

XANTHOMA DIABETICORUM: WITH REPORT OF A CASE.

By D. MURRAY LYON, M.D., F.R.C.P.

THE following case shows several remarkable features, and seems worthy of being recorded:—

History.—The patient was a young man of twenty-six who had been a science student before the war. During the greater part of his service, from 1914 to 1919, he was an instructor in England, but a few months before the armistice he was under training for a commission in the Royal Flying Corps. When he was demobilised in February, 1919, he was in perfect health, and he returned to college to finish his science training. Study he now found very difficult, but he applied himself closely to his work, taking practically no exercise—a great contrast to the active life he had spent in the army. He felt the strain, and began to worry a great deal over his work.

The first symptoms he noticed were a lack of energy, a sense of exhaustion, and a reluctance to settle down to work. This was in April 1920. He also felt drowsy, and began to suffer from gastric disturbance—a sense of fullness after meals, and a dull pain in the stomach usually increased by food.

In June 1920 the patient noticed that he was becoming very thirsty, and was drinking a great deal of fluid without obtaining satisfaction. About the same time he developed an enormous appetite which he was unable to satisfy. Polyuria now became troublesome, and he lost a good deal of weight. Neuritic pains developed in his legs about the end of June. The thirst and the craving for food continued to increase, and constipation troubled him greatly, but the gastric symptoms gradually passed off. His weight at this time was 9 st. 7 lb. On 10th July the patient consulted his doctor, and dieting was commenced. Under treatment the thirst and polyuria became less, and during the next four months he gained 10 lb. His diet was severely restricted at first, but after a short time he was allowed eggs and meat, together with almond or gluten bread. He then began to consume large quantities of butter and fats of all kinds. At the beginning of September a few xanthomatous papules appeared on his elbows, and the rash rapidly spread. The patient was admitted to hospital on 8th November 1920. He was then rather thin, and weighed 10 st. 1½ lb.

His previous illnesses included diphtheria at 3 years of age, neuralgia at 14 and again at 23. In July 1918 he had a slight attack of influenza, with fever lasting only twenty-four hours. Otherwise he has enjoyed

perfect health. No tendency to obesity or diabetes could be discovered in either his mother's or his father's families.

Physical examination showed no abnormality except the presence of a few slightly enlarged lymphatic glands in each axilla. His reflexes were difficult to elicit, because tapping over the flexures was painful on account of his rash.

On admission to hospital the patient was put on an ordinary diet, and it was found that he was passing from 3000 to 7600 c.c. of urine containing considerable quantities of sugar, acetone, and diacetic acid. The percentage of sugar varied from 3.3 per cent. to 5.0 per cent., and from 113 grams to 302 grams of carbohydrate were lost in the urine daily.

In order to test the power of the patient to handle carbohydrate, and to estimate the severity of his disease, a test meal was given on 11th November. A sample of the patient's blood was taken in the early morning when he was still in a fasting state. He was then given 100 grams of glucose dissolved in 400 c.c. of water. Five further examinations of the blood were made during the succeeding $3\frac{1}{2}$ hours. When the first sample of venous blood was drawn, it was found to have a curious opaque or cloudy appearance, and a white "cream" rapidly separated to the top of the fluid (Lipæmia). The fasting level of his blood sugar stood at ·358 per cent., and after ingestion of the glucose the blood sugar increased rapidly in amount until a maximum of .541 per cent. was reached at 90 minutes. Thereafter a slow decline took place. During the five hours following the test meal 40·3 grams of sugar were excreted in the urine.

Fresh moist films made from the blood showed at first the presence of large numbers of fine granules in the plasma, but these rapidly coalesced into larger droplets on the under surface of the cover-glass. A sample of the blood was examined by Mr C. R. Harington, who reported that it contained nearly 10 per cent. of fat mostly in the form of neutral fats of high iodic value (probably butter fats).

An examination of the viscosity of the blood was also made, and this was found to be 7·5 times that of distilled water (normal blood 5·0—using Determann's apparatus and hirudinised blood). The fats separated out in the viscosimeter very soon after the blood ceased to run in the instrument. There were clinically no signs of acidosis, but on account of the obviously faulty fat metabolism it was feared that this condition might develop if precautions were not taken. To avoid this danger, all fats were omitted

from the diet, and carbohydrates were allowed freely to assist in burning up the excess of fat in the system. Blood was taken for a Wassermann reaction on 11th November, but the serum was so milky that the result was obscured. A microscopical examination of the test fluids showed that the red corpuscles were unhæmolysed, and the test was concluded to be negative.

On the 15th November a sample of blood showed a plasma still very cloudy, but the layer of fat that separated to the top was much less in amount than on the former occasions. The Respiratory Quotient examined on this date was ·75. Diacetic acid disappeared from the urine on the 16th November, but traces reappeared from time to time as the diet was increased. Acetonuria was constantly present for more than a month after this.

A second glucose test meal done on the 18th showed both the fasting blood sugar and the apex of the post-prandial curve considerably higher than on the former occasion. This is to be explained by the patient having been taking a liberal supply of carbohydrate during the preceding week.

On 19th November reduction of the other elements of the diet was begun; half the protein and half the carbohydrate were withheld. Large amounts of urine and of urinary sugar were recorded on the 19th and 20th, viz. 7050 to 5400 c.c., 5·3 per cent. and 5·5 per cent., giving a daily loss of 373 grams and 297 grams of sugar respectively. After this date the figures declined. The rest of his food was stopped on 22nd November, and after two days' starvation the quantity of urine had fallen to 3900 c.c. and the sugar percentage to 3·7 (144 grams in twenty-four hours). Small quantities of green vegetable and tomato were given for the next few days in addition to black coffee that he had been having. The fasting level of the blood sugar still stood at ·412 per cent. on the 25th, but five days later had fallen to almost ·3 per cent.

On the 30th November the urine was free of sugar for the first time, and the diet was extended by adding one egg, a small piece of chicken, and 5 oz. of milk. Small quantities of sugar returned in the urine, but again disappeared when the milk was omitted. From 4th December the urine remained sugar-free and the diet was slowly built up. Two eggs were allowed on 8th December. A trace of sugar appeared on 12th December, but was got rid of by one day's fasting. All traces of diacetic acid and acetone cleared from the urine by

the 18th December. On the 21st December the patient ate a small oatcake without causing glycosuria.

The blood sugar-fasting level on 24th December was ·185 per cent.

The patient remained on a somewhat low diet—thrice boiled vegetable with two eggs and a piece of chicken, and one or two oatcakes and a small rasher of bacon—until 31st December. A tablespoonful of porridge was now given, and this amount was increased to four tablespoonfuls by 3rd January without causing glycosuria. Milk was restored to the diet on 22nd January, and half a slice of bread was taken on 26th January without mishap.

The patient was now taking an amount of food which yielded about 1400 calories. His weight during the period of low diet had only fallen to 9 st. 8 lb., but was now restored to 10 st. 2 lb., and he was feeling very fit.

To ascertain how much improvement the patient had made, a glucose test meal was given on 1st February 1921. The fasting blood sugar was now ·111 per cent., and the curve rose slowly to a maximum of ·230 per cent. at ninety minutes. Only a trace of greenish colour was seen in one specimen of urine passed. This result seemed so extraordinary that it was decided to see the effect of administering 150 grams. This was done next day, and again only traces of sugar appeared in the urine. Two days later a still larger dose, 200 grams, was given with a similar result. The fasting level was ·125 per cent., and the rise during the first ninety minutes was practically the same as in the case of the examination of 1st February, but instead of falling away at once the blood-sugar level was maintained for a further hour and then declined. Only one of the samples of urine examined gave a slight greenish tinge with Fehling solution.

The patient left hospital on 4th February 1921. He gave up all idea of continuing his studies, and adopted an open-air occupation which necessitates walking from ten to fifteen miles a day. This he can do with ease. One day in June he cycled thirty-five miles, walked about six, and scrambled about three miles along the shore, returning home fresher than his healthy companions. The patient was examined on 28th October and a glucose meal was given. The findings on this occasion tally almost exactly with the figures for 1st February, when a similar quantity of sugar was taken.

On 16th January 1922 the patient reported that he was

in the best of health, and that there had never been any return of his previous symptoms. His urine has been regularly tested, and has always been free of sugar. His diet is the ordinary fare of the household, and entails no special cooking. It is not as liberal as that of a healthy person, although it contains ordinary bread (7 oz.), cereal pudding (two tablespoonfuls), and potatoes (two tablespoonfuls), and sometimes includes a little jam. On this diet he has steadily gained weight and now turns the scale at 11 st. 7 lb.

The skin condition was diagnosed by Dr Norman Walker. At first when the patient was seen there was a widespread papular rash most marked over the limbs. The nodules were about the size of a small pea, were of a reddish-brown colour at the base and had a yellow centre. They were irritable and bled readily when scratched. Discomfort ceased a few days after dieting was commenced. The papules slowly decreased in size and lost their brown colour, but they were still visible and palpable in October.

Comment.—Apart from the rare skin lesion this case presents several points of unusual interest.

All the symptoms and the examinations of the blood and urine suggest a serious type of diabetes mellitus. The patient had a polyuria reaching 7000 c.c., a glycosuria of 5 per cent., and a daily waste of about 300 grams of carbohydrate, a high fasting level of the blood sugar ·388 per cent., and a very low carbohydrate tolerance as shown by the greatly exaggerated post-prandial rise in the blood sugar. Add to this the xanthoma and the obvious difficulty in dealing with the fats ingested. Such a serious state of affairs in a young man of twenty-five would suggest a very bad prognosis, and yet he has returned to almost perfect health. From this it would seem that in making a prognosis less weight should be given to the evidences of the severity of the disease and more to the amount of improvement that the patient is capable of under treatment. The greatly increased ability to deal with carbohydrates is graphically shown in the annexed table. The figures of 9th November are those of a typical serious case of diabetes, while on 1st February, at the end of hospital treatment, the same amount of glucose only raises the level of the blood sugar a little above normal, and a mere trace of sugar appears in the urine. This remarkable improvement has been maintained for at least nine months.

Blood-Sugar Examinations.

	Meal given.	Fasting Level.	Minutes.							Glycosuria during Test.	
			30.	60.	90.	120.	150.	180.	210.		
		Per cent.								Per cent.	Grms.
1920 Nov. 9th . .	100 g. glucose . .	·358	·426	·460	·541	...	·523	...	·454	4·7	40·3
„ 16th . .	...	...	...	...	...	·741	...	...	...	...	...
„ 18th . .	100 g. glucose . .	·459	...	·597	·761	·755	...	...	...	5·9	38·9
„ 24th . .	...	...	...	...	...	·533	...	...	...	...	...
„ 25th . .	100 g. glucose . .	·412	·413	·421	·412	·392	...	...	...	4·5	13
„ 30th . .	...	...	...	...	...	·317	...	...	...	...	...
Dec. 24th . .	Breakfast . . .	·185	190	190	·167	·149	...	117	...	Nil.	...
1921 Jan. 13th . .	...	...	...	...	·109	...	...	...	...	...	...
„ 29th . .	Breakfast . . .	·102	·174	·187	·147	...	·091	...	...	Nil.	...
Feb. 1st . .	100 g. glucose . .	·111	·138	·191	·230	...	·182	...	·108	Tr.	...
„ 2nd . .	150 „ . .	...	...	...	...	...	...	...	...	Tr.	·4
„ 4th . .	200 „ . .	·125	·196	·227	·222	...	·233	...	·123	Tr.	...
Oct. 28th . .	100 „ . .	·111	·169	·218	·238	·213	·163	...	...	Nil.	...

CRITICAL REVIEW

THE COMPLEMENT-FIXATION REACTION IN TUBERCULOSIS.

By A. NIMMO SMITH, M.B., Ch.B.,
Clinical Pathologist, Deaconess Hospital, Edinburgh.

THE question of the application of the complement-fixation test to tuberculosis has received a considerable amount of attention in recent years, and many workers have carried out investigations as to its diagnostic value.

Widal and le Sourd[1] are said to have been the first to apply this test to tuberculosis in 1901. In 1903 Bordet and Gengou[2] showed that in the serum of guinea-pigs inoculated with tubercle bacilli, substances were produced which had the property of fixing complement in the presence of a specific antigen composed of tubercle bacilli.

Wassermann and Bruck, in 1906, were able to demonstrate a similar reaction in the case of patients who had received inoculations of tuberculin, complement being fixed by the antibodies present in the serum of these patients in the presence of tuberculin. In 1914 Dudgeon[3] undertook some serological tests by the complement-fixation method in guinea-pigs which had been inoculated, subcutaneously or intraperitoneally, with human tubercle bacilli. He was able to show the occurrence of complement-fixing antibodies in the blood of these animals about ten days after inoculation by the subcutaneous route, and in from ten to fourteen days in the animals where the bacilli had been introduced into the peritoneal cavity.

He found that the reaction was more likely to be positive when the test was made about ten days after inoculation than when the disease was allowed to progress for several weeks; although in some of these animals with generalised tuberculosis the reaction was positive, quite a high percentage of the inoculated animals which were dying of a general tuberculous infection gave a negative reaction.

Besredka and Manhoukine[4] also found that the blood serum of guinea-pigs inoculated subcutaneously with tubercle bacilli gave a positive complement-fixation reaction, and that this might occur as early as the fourth day.

I. Principle of the Complement-Fixation Reaction.—The complement-fixation test is based upon the power of fixing or inhibiting complement, possessed by a combination of an antigen and the specific antibodies or amboceptors which have been produced as the result of the action of the antigen.

Complement-Fixation in Tuberculosis

Antigen is the name given to a substance, usually a protein, which, when introduced into the living body, will lead to the production of antibodies. For example, if a rabbit be inoculated on several occasions, at appropriate intervals, with the washed, red-blood cells of a sheep, the serum of the rabbit will be found to have the property of dissolving the red-blood cells of sheep, provided that *complement* is present.

Complement is the name given to a substance which is naturally present in fresh serum. In the example given above a mixture of the washed red-blood cells of a sheep (antigen) and the serum of a rabbit immunised against these cells (antibody or amboceptor) constitutes sensitised cells, and these need only the addition of complement for their solution (hæmolysis) to occur.

In tuberculosis the antigen is, of course, the tubercle bacillus, and in the actual complement-fixation test, the antigen employed must be some preparation or derivative of tubercle bacilli. The antibody will be contained in the serum of a tuberculous patient.

When the appropriate antigen is mixed with the serum of a tuberculous patient, this antigen-antibody combination is able to "fix" complement, and if now to this mixture "sensitised" red-blood cells be added, these will not be dissolved since the complement is fixed. (A positive tuberculous complement-fixation reaction.)

If, on the other hand, the patient's serum used contains no antibodies capable of combining with the tuberculous antigen in this way, the complement will remain free (as the antigen alone cannot fix complement, at least not in the dilution in which it is used in the test), and the free complement will then complete the requirements for dissolving the sensitised cells and hæmolysis will occur. (A negative complement-fixation reaction.)

In this way sensitised cells are made to act as an indicator as to the state of the complement; if the complement is not free hæmolysis will not occur, and since the complement is fixed, it means that the test serum contains antibodies capable of combining with the tuberculous antigen; in other words, that the serum comes from a case of tuberculosis,

If, on the other hand, hæmolysis does occur, it means that the complement is free, and the presence of free complement in a mixture of tuberculous antigen and suspected serum means that the suspected serum contains no antibody capable of combining with its antigen to fix complement.

In carrying out the complement-fixation test in tuberculosis the requirements are:—

1. The *antigen*, which must consist of some preparation of tubercle bacilli.

2. The *serum* to be tested, heated to destroy its natural complement.
3. *Complement*—this is usually employed in the form of fresh guinea-pig serum.
4. The *hæmolytic system*, which consists of—(*a*) Red-blood cells, usually of the sheep, and (*b*) hæmolytic serum, from an animal immunised against the red-blood cells used.

The mixture of red-blood cells and hæmolytic serum is spoken of as sensitised cells.

Put briefly, the test consists in mixing together, in certain definite amounts, the antigen, the heated serum of the patient, and the complement. These are left together at 37° C. for a definite period to allow of any fixation of complement to take place. Finally, a definite amount of the sensitised cells is added, and the result is read after a further period of incubation, the presence or absence of hæmolysis being noted.

The technique of the various workers differs in many details, not only as regards the time allowed for the different stages of the test, but also the actual amounts and dilutions of the different re-agents, while the greatest difference exists in the preparation of the antigens used by different investigators.

In all cases the antigen is derived from the tubercle bacillus, but its method of preparation and final character are by no means the same in each individual case.

It is not to be wondered at that widely different results should have been obtained, and conflicting opinions held by investigators when the antigens used have been so dissimilar. Thus some workers have used ground dead or living tubercle bacilli as an emulsion in saline; others have extracted the bacilli with alcohol and ether, using the dried bacilli as a suspension in saline; others again have used filtrates after extracting the bacilli with alcohol, or with lactic acid, alcohol, and ether. More recently Besredka[5] has introduced a new antigen, growing tubercle bacilli in a special egg yolk medium; the culture is sterilised by heating on the fourth day of growth, and the whole culture is used as the antigen.

Miller,[6] in 1916, classified the various antigens in use and placed them in four groups:—

Group I.—Comprises those which consist of the whole or ground-up tubercle bacilli.

Group II.—Antigens which may be classed as tuberculins.

Group III.—Antigens consisting of extracts or derivatives of tubercle bacilli.

Group IV.—Extracts or preparations of normal and tuberculous tissues.

As regards the antigens made from the whole bacillus, Miller

found that the reported results varied in constancy and in the percentage of positive results; with tuberculins as antigens non-specific results were more apt to be obtained, especially with the sera of non-tuberculous syphilitics, and antigens prepared from tissues did not give uniform results.

II. The Results of the Tests in Tuberculosis. Pulmonary Tuberculosis.—Dudgeon, Meek, and Weir[7] examined the serum in 102 cases of pulmonary tuberculosis which were not being treated by tuberculin inoculation, their cases being of all degrees of severity; 84.3 per cent. gave a positive reaction. Some of the patients in whom the test proved negative, either had tubercle bacilli present in their sputum at the time of the test, or the bacilli had been present a few weeks previously, but most of their negative reactions were in those whose lesions showed no signs of activity at the time of the test.

In ten other cases undergoing tuberculin treatment the reaction was uniformly positive. The antigen used in this investigation was a suspension of dead tubercle bacilli in salt solution.

The same investigators examined a further series[8] of cases of pulmonary tuberculosis, all of whom had tubercle bacilli in the sputum. In this series of cases they used a different antigen, prepared by extracting tubercle bacilli with absolute alcohol.

In 284 patients with pulmonary tuberculosis they found the reaction positive in 89.3 per cent. M'Intosh and Fildes[9] obtained 76.7 per cent. of positive fixation tests in cases of tuberculosis of the lung where a bacteriological diagnosis had been made; while, with the same antigen, Radcliffe[9] found the reaction to be positive in 86.2 per cent. of the 467 pulmonary cases examined by him. The antigen used by these investigators was a suspension of living tubercle bacilli.

An emulsion of living bacilli was used as an antigen by Punch[10] also, who obtained 100 per cent. positive results both in cases with tubercle bacilli in the sputum at the time of making the test, and in those in whom the bacteriological diagnosis was made subsequently. The antigen used by Miller[11] was made by grinding up tubercle bacilli with dry salt, definite amounts of each being taken, and adding distilled water to make the suspension. With this antigen he obtained 96.8 per cent. positive reactions in 284 cases of clinically active pulmonary tubercle.

Miller's antigen has been used by other workers, but their results have not shown such a high percentage of positive reactions as have those of its originator; thus Moon[12] dealing also with cases of active tuberculosis of the lung found that 85.2 per cent. of his cases gave a positive complement-fixation reaction; Burns and his collaborators,[13]

with this antigen, investigated 77 cases of human tuberculosis, and found the reaction positive in 84.4 per cent.

On the other hand, Corper and Sweany[14] report positive findings only in from 30 to 40 per cent. in clinically definite cases of tuberculosis. The last-named workers employed, in addition to Miller's antigen, a special antigen prepared from tubercle bacilli by autolysis, and reported that there was very little difference between the results obtained with these two antigens. Besredka's original antigen[15] was the filtrate of a culture of tubercle bacilli grown in egg broth without the addition of peptone or glycerine. With this antigen Besredka found that a large proportion of tuberculous patients showed a positive reaction, but Inman[16] demonstrated that this antigen gave a positive reaction with the sera of syphilitic patients with a positive Wassermann, although 95 per cent. of the cases of pulmonary tuberculosis examined by him gave a positive tubercular fixation reaction. Very similar results were reported by Leredde and Rubinstein,[17] who recorded 89 per cent. positive results in patients with tuberculosis of the lung, these observers also finding that a large number of sera which were positive by the Wassermann test also reacted positively with Besredka's antigen. This antigen of Besredka's was modified by Craig,[18] who grew tubercle bacilli in alkaline egg broth, treated the growth with 95 per cent. alcohol and filtered, using the filtrate as his antigen. By means of this antigen he examined the sera of patients with active pulmonary lesions and obtained in this class of cases 96.2 per cent. of positive fixation reactions. In a later report he records 96.6 per cent. of positive results in the same type of case.

Craig's antigen was employed by M'Caskey,[19] who found, however, that the reaction was positive in 77.7 per cent. of clinically tuberculous cases, and only 71 per cent. of those with tubercle bacilli in the sputum reacted positively to the test.

Other workers have prepared antigens from tubercle bacilli which have been acted upon by alcohol, ether, lactic acid, etc.

Wilson[20] prepared his antigen by extracting the bacilli by means of alcohol and ether, drying the extracted bacilli and suspending them in saline. With this antigen Wilson obtained, in cases of active pulmonary tuberculosis, 92 per cent. of positive results, 67 per cent. being strong positives, and 25 per cent. weakly positive. Using the same antigen, however, Stoll and Neuman[21] reported only 58 per cent. of their cases as giving a positive result. Von Wedel also employed Wilson's antigen, and after examining a thousand patients found that about 70 per cent. of all types of tuberculous patients, except those clinically healed or inactive, gave positive results.

Wang and Crocket [22] employed an antigen prepared from tubercle bacilli treated with alcohol, ether and chloroform to remove the fatty substances. With this antigen they examined, among other tuberculous patients, 97 cases of pulmonary tubercle, some having tubercle bacilli present in the sputum, and some without bacteriological evidence. Of 57 patients in whom sputum examination showed tubercle bacilli, 49 reacted positively with this antigen, while of 48 cases in whom tubercle bacilli were not found, 33 gave a positive fixation reaction—giving a total of 84.5 per cent. positive results in their pulmonary cases.

Calmette and Massol,[23] in 1912, introduced a special antigen which was a peptone solution preparation of tubercle bacilli; with this antigen 92.5 per cent. of their tuberculous cases reacted positively to the test.

Employing Besredka's new antigen [5] different observers have recorded a high percentage of positive results.

Bass [24] records 100 per cent. of positive results in 130 cases definitely suffering from pulmonary tuberculosis.

Fried [25] had 94 per cent. positive in 150 patients with pulmonary tubercle, while Goldenberg and Fried [26] found 93.7 per cent. positive out of 145 sera from cases of tuberculosis of the lungs. Some of the patients in whom the disease was far advanced reacted negatively, and all of these died in from eight days to six weeks from the time the test was made.

(*To be continued.*)

OBITUARY

WILLIAM CRAIG, M.D., F.R.C.S.E.

The passing of Dr William Craig removed the *doyen* of the medical profession in Edinburgh, and a personality, less familiar to the present generation of practitioners, than to that immediately preceding in which he occupied a prominent position in the medical school and community.

Dr Craig was born in Strathaven, Lanarkshire, in March 1832, so that he had well nigh completed his ninetieth year at the time of his death on 3rd February 1922. The son of a farmer he was a member of a long-lived family. He received his education at Glasgow University and passed through the Divinity Hall of the United Presbyterian Church with a view to its ministry, but changed his mind and took to the study of medicine which he pursued at Edinburgh, graduating M.B. and C.M. in 1868, M.D. in 1870, and becoming F.R.C.S.E. in 1874. Commencing medical study at an age considerably beyond the average of

that of his compeers, he yet aligned himself with the interests of his fellow students and was a zealous and enthusiastic worker in all departments. Natural science, more especially botany, had much attraction for him throughout his career, and this no doubt had its influence in inclining him towards the selection of the subject of Materia Medica to which he ultimately devoted a large share of his life as a teacher in the Edinburgh Medical School. This special work he began as instructor in practical pharmacy in the New Town Dispensary, and he soon became a Lecturer on Materia Medica and Therapeutics in the Extramural Medical School, first at Minto House and thereafter for many years at Surgeons' Hall. He proved a painstaking and successful teacher, continuing at this work till a few years before his death. Dr Craig held the post of Examiner in Materia Medica and Therapeutics for the qualification of the Royal Colleges, and was for two terms of five years an Examiner on the same subjects for the degrees of Edinburgh University. During the active period of his life he carried on a large general practice.

Dr Craig took a keen interest in the work of the chief medical societies and was rarely absent from their meetings. He rendered valuable service as Treasurer of the Edinburgh Obstetrical Society, and he acted for many years as Editor of the *Transactions of the Edinburgh Medico-Chirurgical Society*, which is indebted to him for compiling, with the aid of his son Dr John Craig, a useful analytical index of the first twenty volumes of the new series of that publication. To his special subject he made not a few important contributions in the medical journals of the day.

Dr Craig throughout his career showed an active interest in the subject of medical education and was, from its start, one of the Lecturers in the Edinburgh Medical College for Women.

Possessing uninterrupted good health, Dr Craig enjoyed an active outdoor life until the limitations imposed by advancing age rendered this no longer attainable, and his later years were passed in contented retirement. Always attached to the church of his fathers he was, as long as he was able, an Elder in the United Presbyterian, now the United Free Church.

Dr Craig was a conspicuous example of a useful and energetic professional career. Possessed of strong views he had ever courage in expressing his opinions; but in this there was an entire absence of personal feeling, and behind all there glowed a warm and tender heart, and the "love that worketh no ill to his neighbour." Altogether it may be truly said of Dr William Craig that throughout his long life he exercised a wholesome influence among his professional brethren, and in the wide circle of his friends. J. O. A.

Photo by] [*Shaw, Edinburgh.*

WILLIAM CRAIG, M.D., F.R.C.S.E.

NEW BOOKS

Encyclopædia of Midwifery and the Diseases of Women. By JOHN S. FAIRBAIRN, M.A., F.R.C.P. Pp. xv. + 950, with 175 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price 3 guineas.

Designed especially to meet the requirements of the general practitioner the scheme of this book will appeal to its readers. The articles are written by well-known authorities in the teaching schools in all parts of the country, and they are simple, concise, and comprehensive.

The articles on hygiene and management of pregnancy, and on the minor ailments of abnormal pregnancy, lay before the reader all the experience of the work of recent years in antenatal clinics. A much larger space is devoted to the consideration of the care of the new-born infant than is usual in a book on Midwifery. The development of preventive medicine demands that the obstetric physician should devote more attention to the infant, and this section will be found most helpful.

In the sections dealing with Diseases of Women, the classification is pathological and not anatomical as has been customary in the past. Consequently, under the heading of infections one gets a complete picture of any particular pelvic infection, instead of scraps of information under the headings of inflammations of various viscera.

The public health and medico-legal aspects of midwifery and gynecology are fully discussed.

The names of the contributors and the editor are a guarantee of the value of this work. It is a book which will be greatly appreciated by all practitioners.

The Dictionary of Practical Medicine. Edited by Sir MALCOLM MORRIS, K.C.V.O., FREDERICK LANGMEAD, M.D., F.R.C.P. (Lond.), and GORDON M. HOLMES, C.M.G., C.B.E., M.D. (Dub.). 3 volumes. Pp. 1795, with 157 illustrations. London: Cassell & Company, Limited. 1921. Price £5, 5s.

This massive work in three volumes claims to appeal chiefly to the practitioner, "the recognition and treatment of disease" being the governing aim of the work. It is said to cover the whole range of medicine with the exception of fractures, dislocations, and labour (normal and difficult); the diseases of pregnancy and puerperium and diseases of women in general being, however, included. Such general subjects as Immunity (an article of 14 pages), Anæsthetics, Problems of Forensic Medicine, and Life Insurance Examination are also dealt

with; and it may be here stated that mental affections receive, as a rule, a fuller consideration than in many books on medicine. Dr Gordon Holmes has charge of the Neurology, Sir M. Morris the Dermatology, Professor Langmead sharing with the latter the editorial responsibility of the remainder.

With the exception of several well-known contributors from overseas, nearly all the writers are men on the staff of London hospitals—only three contributors from Scotland figure in the list—so that the work may be fairly taken as practically the production of London teachers.

With such a large work the reviewer can dip merely, at random, into certain articles, but, viewing it as a Dictionary of *Practical* Medicine, there appears at times a lack of proportion in the space allotted to some of the articles. Thus while "Valvular Disease of the Heart" fills 15 pages, the whole subject of "Disturbances of Speech" occupies less than one and a-half pages (Aphonia getting only a few lines), and "Stammering" (based largely on Scripture's work) receives scanty notice, in which the reason why stammerers can *sing* what they cannot *speak* is stated to be that "singing does not awaken the emotional complex associated with the speaking voice"—surely begging the whole question.

The articles on recent work in war diseases are mostly well done, notably L. Rogers' lucid, terse, and practical one on "Cholera"; but, on the other hand, Sub-acute Bacterial Endocarditis does not figure at all as an entity, though it is included, in a sense, under "Malignant Endocarditis" in the 8-page article. But nowhere throughout this is the association of Sub-Bacterial Endocarditis with wounds or the infections of active service ever alluded to, although the large proportion of recorded cases seem to have occurred in service patients.

Under "Trench-foot," again, one misses any reference to the best methods of treatment for the intense recurrent pains in convalescing cases, a subject on which, unfortunately, there was no lack of opportunity or investigation.

Sir Robert Philip's masterly article on "Tuberculosis from the Standpoint of Preventive Medicine" forms a noteworthy contribution from Scotland, and the surgical subjects appear to be dealt with in a practical manner from a practitioner's aspect.

One misses reference to Luminal in the treatment of "Epilepsy"; and the importance of recognising the significance of sudden cessation of sweating, coupled with disappearance of joint pains as *premonitory* evidence of the onset of hyperpyrexia in rheumatism is not brought out.

Most of the illustrations are excellent; the paper and printing of the work are extremely good, though the breadth of the volumes makes them a little unwieldy. For those desirous of possessing a good up-to-date work for reference this can be safely recommended.

New Books

Operative Surgery. By J. Shelton Horsley. Pp. 721, with 613 illustrations. London: Henry Kimpton. Price £2, 12s. 6d.

This book represents in a concise manner much of the modern teaching on operative surgery. As is to be expected from the nationality of the author, American ideals and methods bulk largely in the pages; in the opinion of many this qualification has strong recommendations.

Horsley's name is familiar, because of the observations he has published in regard to surgical drainage; the second chapter of the volume is devoted to a summary of the author's views in this connection. While the simplicity of the theory (reversal of the lymph circulation) is attractive, it appears to us to neglect certain obvious pathological changes, such as leucocytosis, fibrin formation, and lymph coagulation. The chapter dealing with technique, sutures, and instruments is the weak link in the sequence of the book, and, if the volume is to commend itself to students, or at least is to be recommended to students by their teachers, the defect must be remedied. The great principles which underlie the art of operative surgery are scantily dealt with; from the teacher's point of view this is the most serious criticism of the work.

Throughout the book there are evidences of a somewhat incorrect and loose method of expression—*e.g.*, "Branchial cysts result from an incomplete closure of the branchial clefts" (p. 305); "the breast adherent to the chest wall" (p. 435). Kocher's incision for excision of the hip by the posterior route is not described as it was in the original. The author does not apparently distinguish between cholecystotomy and cholecystostomy—the former he describes by a technique which is applied to the latter. "Lambert" sutures should read "Lembert" sutures. It would have been an advantage to have included a chapter on anæsthesia.

Apart, however, from these criticisms, the book has great recommendations. With the exception of the chapters dealing with scalp, skull, and brain, the subject-matter is thoroughly up to date; the portion dealing with abdominal surgery is especially good. The illustrations are clear and well produced; the subject-matter is presented in a clear and readable style. The author has succeeded in producing a most readable treatise.

BOOKS RECEIVED

BLAND-SUTTON, Sir John. Tumours Innocent and Malignant. Seventh Edition . . . . . (*Cassell & Co., Ltd.*) 30s.

BREND, WILLIAM A. Handbook of Medical Jurisprudence and Toxicology. Fourth Edition . . . . . (*Charles Griffin & Co., Ltd.*) 10s. 6d.

BUTLER, GLENTWORTH REEVE. The Diagnostic of Internal Medicine. Fourth Edition . . . . . (*D. Appleton & Co.*) 45s.

CAMPBELL, W. F. A Text-book of Surgical Anatomy. Third Edition (*W. B. Saunders Co.*) 30s.

CLARKSON, ERNEST R. T. The Venereal Clinic (*Bale, Sons & Danielsson, Ltd.*) 25s.

COLWELL, HECTOR A. History of Electrotherapy and Diagnosis (*Wm. Heinemann (Medical Books), Ltd.*) 17s. 6d.

CORE, DONALD E. Functional Nervous Disorders (*John Wright & Sons, Ltd.*) 25s.

FAUGHT, FRANCIS ASHLEY. Essentials of Laboratory Diagnosis. Seventh Edition . . . . . (*F. A. Davis Co., Philadelphia*) $4.50

FOTHERGILL, W. E. Manual of Diseases of Women. Second Edition (*W. Green & Son, Ltd.*) 10s.

FUNK, J. C. Vice and Health (*J. B. Lippincott*) 6s.

GROVER, BURTON BAKER. Handbook of Electrotherapy (*F. A. Davis Co.*) $4.00

GUY'S HOSPITAL REPORTS. Vol. II. Fourth Series, No. 1 (*Oxford Medical Publications*) 12s. 6d.

JELLETT, HENRY. Midwifery for Nurses. Sixth Edition (*J. & A. Churchill*) 9s.

LUKE, T. D. Manual of Physio-Therapeutics. Second Edition (*Wm. Heinemann (Medical Books), Ltd.*) 25s.

MACEWAN, JOHN A. C. Text-book of Surgery. (*Maclehose, Jackson & Co.*) 30s.

M'GRATH, JOHN J. Operative Surgery. Sixth Edition (*F. A. Davis Co., Philadelphia*) $8.00

MAGIAN, A. C. Manual of Gynæcology (*W. Heinemann (Medical Books), Ltd.*) 21s.

MAYO FOUNDATION AND MEDICAL SCHOOL, Papers from 1915-20 (*W. B. Saunders Co.*) 50s.

PAULI, Wolfgang. Colloid Chemistry of the Proteins, Part I. (*J. & A. Churchill*) 8s. 6d.

SCHAFER, E. S. Experimental Physiology. Third Edition (*Longmans, Green & Co.*) 6s.

SMITH, A. LAPTHORN. How to be Useful and Happy from Sixty to Ninety . . . . . (*John Lane, The Bodley Head, Ltd.*) 5s.

TIDY, HENRY LETHEBY. Synopsis of Medicine. Second Edition (*John Wright & Sons, Ltd.*) 21s.

TURNER, JOHN P. Ringworm and its Successful Treatment (*F. A. Davis Co.*) $1.00

TURRELL, W. J. The Principles of Electrotherapy (*Oxford Medical Publications*) 12s. 6d.

VAUGHAN, VICTOR C. Epidemiology and Public Health. In Three Vols. Vol. I, Respiratory Infections (*Henry Kimpton*) Sold only in Sets, 45s. per Vol.

Edinburgh Medical Journal

May 1922

GONORRHŒAL RHEUMATISM, WITH DETAILS OF A NEW METHOD OF TREATMENT.*

By A. O. ROSS, M.D., Ch.B.

Symptomatology.

Stage in the Disease.—Infection of the joints is possible in the course of an acute urethritis at any time after extension of the disease to the posterior urethra. This usually occurs in the third or fourth week of the disease, but in some cases, notably in alcoholic patients, the extension is more rapid. If gonorrhœal rheumatism occurs before the fourth week of the disease, as a rule the condition is one of relapse. If prostatic examination per rectum reveals nothing abnormal a previous gonorrhœal rheumatism is probably the accelerating factor. In the great majority of cases giving a history of long-continued discharge, with or without joint complications, one finds the evidence of incomplete cure in a chronically thickened vesicle. Quite a number of such cases gave a history of persistent purulent discharge suddenly disappearing, probably as a result of blockage of the ejaculatory duct. This same reason explains why in acute epididymitis there is often cessation of discharge for a few days before the epididymis flares up. This apparent cure commonly gives rise to that paradoxical syndrome of (1) acute epididymitis, (2) acute arthritis, (3) purulent discharge coming on within forty-eight hours of exposure to fresh infection or indulgence in alcohol. This may occur at any date after the original and only infection. I have seen two cases after fifteen years, one after thirteen and one after twelve years' freedom from any discharge or definite symptom.

* Abstract of a Thesis for the Degree of Doctor of Medicine, University of Edinburgh.

Conditions in the Genital Tract.—I believe that previous infection of a seminal vesicle is necessary in a gonorrhœal metastasis whether to eye, tendon, or joint. Per rectum one or both vesicles are palpable, and varying degrees of tenderness are present depending largely on the chronicity of the lesion. In a large percentage of cases, the prostate also is infected, and should the joint infection supervene on an acute posterior urethritis, the prostate becomes excessively swollen, œdematous, and tender. In every case of joint infection that I have treated, the vesicle of the same side as the first joint attacked has been the more severely infected of the two vesicles and commonly has been the only one.

The urethral discharge which is usually present in joint infections is generally of the "morning drop" type. The appearance of a more profuse urethral discharge of decided purulence is more favourable, as it probably indicates that the affected vesicle is draining freely into the prostatic urethra. The patient soon experiences relief of pain in the joint, and the effusion subsides.

Conditions in the Joints.—The classification given in Osler and Macrae's *System of Medicine* is the simplest and most comprehensive.

(a) *Arthralgic Type.*—In this condition the symptoms are altogether subjective. The patient complains of pains in the muscles and joints, but no redness nor swelling can be made out. Tenderness is not present. Stiffness and slowness of active movement are apparent.

(b) *Polyarthritic Type.*—This is the typical gonorrhœal rheumatism. One joint is usually affected to begin with and soon after several joints become involved almost simultaneously. The joints are swollen, the overlying skin is red, and great tenderness is present. In my experience the peri-arthritic tissues are not œdematous but the joint cavity is tense with fluid consisting of synovial fluid and sero-purulent exudate.

The joints first affected are commonly those of the lower extremity. Generally the knee is the first to be inflamed, then the ankle and hip, and the joints of the foot. There is no definite sequence of events but it is unusual to see two joints in one limb affected without one or both of the corresponding joints in the other extremity becoming inflamed.

Any joint in the body may show signs of infection and

special emphasis has always been laid on the involvement of the sterno-clavicular and temporo-mandibular joints because of the freedom from infection of these joints in acute rheumatism.

According to Finger,[14] in 376 cases of arthritis the frequency of infection of the various joints was as follows: Knee, 136; ankle, 59; wrist, 43; digits, 35; elbow, 25; shoulder, 24; hip, 18; temporo-maxillary, 14; metatarsal, 7; sacro-iliac, 4; sterno-clavicular, 4; chondrocostal, 2; inter-vertebral, 2; tibio-fibular, 1; crico-arytenoid, 2.

The influence of occupation on the joints selected by the disease is well known, and I have been struck by the large incidence of sacro-iliac and acromio-clavicular arthritis in sailors. I feel certain that changes occur in the sacro-iliac joints of all who go down to the sea in ships analogous to those that occur in the parturient woman. The lurching gait of the sailor is typical and is due to the presence of a mobile joint between the sacrum and ilium.

As time goes on one joint after another clears up but the last to get well is always the joint originally infected. Muscular wasting about this joint is especially marked.

At the ankle and wrist in poly-arthritic rheumatism the condition differs from that seen in the other joints. In all other joints the outstanding feature is the actual distension of the joint with exudate. In the ankle and wrist, the distinctive feature is the involvement of the tendons in the neighbourhood of the joint. At the ankle the peronei and flexor tendons are more affected, and at the wrist the extensor tendons. The condition in these situations is very chronic and long after pain and tenderness have gone, thickening of the tendon sheaths and swelling sufficient to obliterate the inter-tendinous spaces persists.

(c) *Chronic Hydrarthrosis Type.*—Here the joint selected is generally the knee. The onset is insidious. There is little if any pain. No redness or tenderness is apparent, but the joint is almost full of fluid though rarely tense. There is also considerable peri-arthritic œdema. The patient's complaint is of inability to move the joint and of difficulty in bearing the weight of the body on the affected leg. Occasionally pain comes on at night sufficient to prevent sleep.

The condition is usually mono-articular, but fairly commonly there is a transient hydrarthrosis of the corresponding joint in the opposite limb. It is usually very chronic and few pus cells

are obtained in prostato-vesicular smears or in fluid withdrawn from the joint.

The urethral discharge is always mucoid in character, which probably implies low resistance to the gonococcus. In polyarthritic-gonorrhœal rheumatism the patient is generally pale and anæmic. He is wasted in greater or less degree and his skin is dry and sallow. The temperature is generally raised but slightly. At the onset, temperatures up to 103° F. are fairly often seen, but as the disease progresses a temperature of 99° to 100° F. is more common. The appetite is poor and the patient is generally dejected. Want of sleep, in the acute stages, is often one of the main complaints. Position is always cramped and the patient cannot bear the weight of the bedclothes on the affected joints.

A peculiar tapering of the fingers is seen if the elbow, wrist, or one of the small joints of the carpus or metacarpus is affected. This appearance of tapering is more apparent than real but constitutes a very constant sign. I have never seen it in acute or chronic rheumatic affections, but in tuberculous disease of these joints it may be seen late in the disease. The appearance is due in part to a loss of tissue about the sides of the nails and also to the total or partial obliteration of the skin folds on the dorsum of the interphalangeal joints, especially of the distal joint; in gonorrhœal arthritis of the wrist it is typically exemplified in the index finger. A similar though less-marked condition is seen in the toes when the ankle is affected.

Treatment.

Treatment resolves itself into:—(1) Rest for affected joints; (2) Extirpation of the genital infection; (3) Early and drastic abortive treatment of the affected joints; (4) Tonic treatment.

Rest in bed is essential for all cases where joints of the trunk and legs are affected, and it must be specially enjoined for many days after apparent cure, more particularly in cases of ankle infection because of the involvement of the plantar tendons. Should the patient not be kept strictly in bed, flat foot will most certainly develop.

In elbow, wrist, and hand joint infection, the patient may be allowed out with a sling to support the forearm and hand, and should the wrist be affected an angled splint to keep the wrist in a position of dorsiflexion is necessary.

The genital infection is best treated by daily prostato-

vesicular massage during the stage of acute inflammation of the joints, and by bi-weekly massage and topical applications in the later stages. Before massage each patient is instructed to fill his bladder with 1/5000 silver nitrate or oxy-cyanide of mercury (1/8000) after thorough lavage of the anterior urethra following micturition. By this method smears of prostato-vesicular fluid will show the progress of the condition by the incidence of pus cells per microscopic field.

The position most suitable for expression of the contents of the vesicles is obtained by causing the patient to lie supine with the lower part of the sacrum at the edge of the table; the hips and knees are then flexed so that the heels rest on the edge of the table just external to the hips. The head and shoulders are supported by one pillow. A satisfactory modification of this position when the knee-joints are affected is attained by having the patient's ankles supported while he lies with legs extended and abducted.

By a system of weekly pus-cell per field counts under 1/12 in. objective, I found that 5 per cent. "argirina," a ses-albuminate of silver of Italian origin, was superior to silver nitrate (1–4 per cent.); methylene blue in glycerine (methylene blue, 1; glycerine, 25; water ad. 100); and protargol 5 per cent., or prostatic massage alone. These experiments showed that while instillation of the posterior urethra prior to massage with argirina reduced the pus cells per field at the rate of 2 per diem, protargol reduced them at the rate of 1·25 per diem, silver nitrate 1 per diem, and methylene blue and prostatic massage alone at the rate of ·75 per diem.

Besides this direct treatment the general measures for the relief of joint infection have a beneficial influence on the genital infection. Tonic treatment includes measures such as massage, hydrotherapy and radiant heat, while general tonics, such as mixtures containing iron, arsenic, and strychnine, do much to help the patient in the convalescent stage.

Abortive treatment to the affected joint is usually of a general nature—intravenous, intramuscular, or subcutaneous injections of various substances, though Debre and Paraf[1] report benefit from aspiration of the affected joint followed by intra-articular injection of anti-gonococcal serum. Injection of chemical compounds has been advocated by M'Donagh[2]—"intramine" two 1·5 c.c. intra-muscular injections at an interval of three days followed by 2·5 c.c. a week later.

This treatment, he states, is enhanced by the intravenous administration of collosol iodine 100 c.c. on the day preceding.

Levy, Bing, and Duroeux[3] recommend sulfarsenol 3 to 5 injections varying in dosage from ·06 gram to ·18 gram or in some cases up to ·36 gram. Stern and Ritter[4] have tried sodium iodide in 10 per cent. solution in doses of 20 c.c. intravenously. Daily injections are given, and it is stated that no reaction follows, and thus it may be given in the consulting-room, and the patient given leave to continue his occupation.

Intravenous injections of colloidal sulphur and mercury are advocated by Mukerjee.[5] The original dose is ♏ iv., followed in forty-eight hours by ♏ vi. The increase of ♏ ii. every forty-eight hours is dependent on their being no reaction.

The rational treatment by injection of anti-gonococcal serum and gonococcal vaccine has produced successful results in numerous cases, but the majority of cases are resistant to ordinary vaccine methods and dosage.[5] Better results have accrued from the use of foreign protein. Fraser and Duncan[6] reported on the beneficial results of treatment by massive doses of non-specific vaccines and diphtheria antitoxin of mature age. Harrison,[7] Miller and Lask,[8] and Reensterna[9] have had excellent results in chronic cases with the injection of large doses of anti-typhoid vaccine. More astonishing are the results published by Nolf,[10] following the injection of peptone solution intravenously. The reaction is excessively severe, and relapse is prone to occur if further injections are not given. Intramuscular injections of milk have been employed. Divergent views on its utility are expressed by Schulman[11] who has had success, and by Trossarello,[12] who has failed to note any improvement.

In the treatment of over 30 cases of arthritis occurring in my own practice, I have adopted a method—partly chemical and partly rational vaccine.

The chemical substance used was colloidal silver in the form of "electrargol," and the vaccine was the mixed vaccine made by Sir Almroth Wright, containing 500 million gonococci per cubic centimetre, together with staphylococci, streptococci, and B. coli.

Isotonic electrargol is a dark brown, almost opaque liquid, containing silver in colloidal solution. The dosage recommended is from 10 c.c. to 20 c.c., but I have only given 20 c.c. doses on four occasions (Case I.). Electrargol has been employed in many affections, both local and general,

including pneumonia and syphilis, and Luys recommends its use in local injections into the inflamed epididymis after aspiration of that organ.

The routine for giving intravenous electrargol is substantially the same as for giving intravenous neosalvarsan. Previous experience in giving intravenous injections is necessary, since one must know well the sensation of having the needle in the lumen of the vein. Electrargol is of so dark a colour that the entrance of blood into the syringe is not observed. The patient ought to be in bed, and have Ac. acetosalicylic (gr. xv.) immediately before the injection, and again four hours later. I am of opinion that this materially shortens the pyrexial reaction which follows. The patient is well covered with blankets, and hot-water bottles ought to be in readiness.

In the typical case, and especially after the first and second injections, the patient complains of inability to keep warm, and in from half an hour to two hours a rigor comes on. Thereafter the patient feels warmer and sweating supervenes. Sometimes the sweating and radiation of heat is so great that the patient has the appearance of "steaming." If questioned he will say that he feels the electrargol "working" in his joints. This may be due to the unwonted movement of the rigor, but in many cases where no rigor developed the same aching was complained of. Temperature at this time is rarely above 102° F.

About six hours after injection in the most satisfactory type of case a remarkable change has occurred. The patient is free of all aching and pain on movement, and may proceed to demonstrate his new-found power by moving his limbs vigorously under the bed-clothes. The general demeanour of the patient in almost all cases has changed from despondency to optimism, and one is better to caution him about his future and restrain him from moving his joints overmuch.

Time and again patients have reported that they had slept all night for the first time for many days and perhaps weeks. Sleep previous to the administration of electrargol had been extremely fitful on account of the starting pains which had come immediately the muscle defence of the inflamed joints had relaxed. Case II., who, on admission as a cot case, lay with his right leg everted and the left side of his body raised from the bed, reported that after the first injection he had gone to sleep in that strained position and awoke next morning lying on his left side and with his right leg flexed at the knee.

The following morning it is usual for the patient to complain that he is not quite so well. This is found to refer to the fact that the affected joints are rather stiffer than on the previous evening. There is little, if any, aching, and the stiffness passes off in the course of the day.

The second injection is given forty-eight hours after the first, and with it may be combined a prostatic massage. The following day the decrease in the joint effusion is seen. Bony landmarks are becoming visible, local heat is scarcely perceptible, and redness over the joint has entirely disappeared.

Further injections of electrargol are given at two-daily intervals, and these are combined with massage of the prostate and stripping of the vesicles until the joints return to normal. In this connection it is advisable to state that a slight transient hydrops of a joint may recur. This I ascribe to (1) further auto-inoculation from the focus in the prostate and vesicles; (2) too vigorous and prolonged movement on the part of the patient who imagines that because all pain has gone his joint is entirely cured. To support the second theory, one discovers certain tender areas about the affected joint corresponding to the osseous attachments of the articular ligaments or muscles.

The above description relates to the effects following a 10 c.c. initial injection. By employing 5 c.c. only, and by giving the first injection intramuscularly, the same therapeutic effects are produced without the undesirable rigor.

Further phenomena observed were the development of herpes labialis in 16 per cent. of cases, and urticaria in 5 per cent. of cases. In one patient, urticaria developed after both the second and third injections. No albuminuria occurred in any case treated.

Of interest in view of M'Donagh's theory that the positive Wassermann is due to an increased number of protein (colloid) particles in the blood, is the fact that the Wassermann reaction of patients treated by electrargol was "positive" by the cold-fixation method, provided the blood was withdrawn within twenty-four hours of the injection.

The routine treatment is appended:—

1st day .	5 c.c.	Electrargol (intramuscular).
2nd day .	5 c.c.	Electrargol (intravenous). Prostato-Vesicular Massage.
3rd day .	10 c.c.	Electrargol. Prostato-Vesicular Massage.
4th day .		Prostato-Vesicular Massage.

5th day .	10 c.c.	Electrargol. Prostato-Vesicular Massage.
6th day .	.1 c.c.	Wright's Vaccine.
7th day .	10 c.c.	Electrargol.
8th day .		Prostato-Vesicular Massage.
9th day .	.2 c.c.	Wright's Vaccine.
11th day .		Prostato-Vesicular Massage.
12th day .		Prostato-Vesicular Massage.
13th day .	.4 c.c.	Wright's Vaccine.
15th day .		Prostato-Vesicular Massage.
16th day .		Prostato-Vesicular Massage.
17th day .	.6 c.c.	Wright's Vaccine.
19th day .		Prostato-Vesicular Massage.

Should the negative phase following the vaccine injection result in arthritic pain and effusion, the administration of 10 c.c. electrargol acts as a specific. When it was necessary to break down adhesions in a mal-treated joint, 10 c.c. of electrargol was given on the table, and in no case did metastasis to the iris or unaffected joints occur, nor was there acute exacerbation in the affected joint.

In gonorrhœal metastatic infections of the eye electrargol has been of great service, and three cases of eye infection are reported below, together with three cases of joint infection which show the rapid therapeutic action of this preparation.

Case I.—*History.*—Original infection 1912. Six weeks later patient suffered from arthritis of right ankle and left shoulder. Discharge disappeared and iritis supervened. In 1916 a relapse of purulent discharge occurred and this disappeared as suddenly as it came. Until 1919 patient had no further trouble, but in that year another attack of iritis came on and discharge again appeared. In April 1920, conjunctivitis caused patient to be admitted to hospital. No discharge present and prostatic smears showed epithelial cells only. When the eye condition improved, patient was discharged to duty. Within a week patient was re-admitted to the eye ward suffering from conjunctivitis complicated by arthritis. The eye condition was again cured and patient was transferred on 14th June to the venereal block. On admission to this section, patient had no discharge or threads in the urine. Prostatic smears were negative for pus cells and gonococci. The right ankle joint and more especially about the tendons of the long plantar flexors was red and œdematous and tender; the right knee was tense with fluid and was extremely painful and the right sacro-iliac joint was swollen and tender. In swift succession the infection involved the acromio-clavicular joints and the left knee. Patient complained of lack of sleep and looked

extremely ill. Prostatic massage after the passage of large sounds up to 28 to 32. Charriere, on one occasion only, produced pus cells to the extent of four per field (1/12 objective) but no gonococci were demonstrable.

Stock vaccine containing gonococci and secondary organisms was tried, and patient was a little improved but was sleeping less than one hour per night and aching was constant. Temperature oscillated between 99° and 100° F. Since admission radiant heat and light massage of the muscles acting on the joints had been employed.

On *11th July* patient was losing hope, and it was decided to give an intravenous injection of electrargol. An hour after injection patient had a severe rigor. Temperature 102° F. Six hours later temperature was 100°, and twelve hours later patient was sweating profusely and temperature was 102° F. At 8 P.M. next morning temperature was 98.4° F. (twenty hours after injection), and at ten o'clock patient walked up a flight of stairs (twenty-seven steps) with the aid of a stick, to have prostatic massage. His expression was radiant with joy, and he stated that his knees were free of pain, and gave it as his opinion that "another two injections would see him back to duty."

In all, ten injections were given this patient at three-daily intervals.

The following is a résumé of further progress:—*12th July*—Patient slept all night from eleven o'clock till six next morning. *14th July*—Knees are free of pain and swelling is appreciably less. Other joints though improved are still aching a little. *17th July*—The ankle is still swollen in region of tendon sheaths below internal malleolus, but patient states that he has no pain there. The left acromio-clavicular joint is still troublesome and aches. *20th July*—Pain has now entirely gone from the left shoulder but patient has discovered a tender area on the sacrum corresponding to the short posterior sacro-iliac ligament Rt. There is still a chronic thickening below the internal malleolus Rt. and patient complains of pain in the sole of foot under the bony instep. Patient was cautioned to lie up and not bear any weight on the foot. *8th August*—No pain or aching anywhere. The inter-tendinal spaces about the right ankle can be recognised. Massage treatment continued, and patient was discharged to duty in perfect health on 21st September.

Case II.—Aged 24. Contracted gonorrhœa in Malta, 3rd July 1920. Bursitis left knee, 17th July 1920. Arthritis right knee, 7th August 1920.

Admitted *27th August* 1920. Patient was extremely thin and emaciated. He was racked with pain and presented an appearance consistent with the final stages of pulmonary tuberculosis. The bursitis had been drained and was healed, but patient had had no sleep since 7th August. There had been no improvement in the joint condition.

The right knee was tense with fluid and patient could not bear to have one touch it. The joint was absolutely fixed and patient's decubitus very strained. The right leg lay everted on the bed and patient rested partly on his back and partly on his right side. The left leg was flexed at the hip and knee, and was abducted as if to protect the right knee. He states that he had kept this position for almost three weeks and dared not sleep.

On 28*th August* 5 c.c. electrargol was given intravenously. He had no rigor or rise of temperature and slept for six hours that night. Next morning he found that he had turned during the night without feeling any pain. The joint was perceptibly less swollen and patient could bear to have it palpated. In a week's time all pain and fluid had gone and flexion to more than a right angle was possible. Massage and movement were carried on and the urethral condition treated. Within two months, patient was fit for full duty.

Case III.—Treated by six injections of electrargol and vaccine at four-daily intervals. *History*—Gonorrhœa 1911, and had a gleet ever since; arthritis in 1919, without further risk; exposed to infection 22nd September 1920; purulent discharge noted 30th September 1920; no sleep for two nights since development of arthritis in right hip.

Admitted on *7th October* 1920. Temperature 102° F.; right hip swollen and exquisitely tender; patient dare not turn in bed or attempt the slightest movement. *8th October*—10 c.c. electrargol intravenous; 6 P.M. no aching in hip; hip can be fully flexed and patient can turn in bed. 18*th October*—Patient was able to walk about in the ward easily and without limping.

Case IV.—Case of iritis with arthritis both shoulders, left knee, and both hips. *History*—Gonorrhœa 1916. Syphilis 1919. No further risks since syphilitic infection. 30.6.20.—Admitted with arthritis of shoulders, right knee, and both hips. 21.7.20.—Conjunctiva injected; iris fixed; cornea cloudy. 31.7.20.—Condition as above; conjunctiva like a lake of blood; joints aching; movement very limited; electrargol 5 c.c. 1.8.20.—Appearance of eye greatly improved; the injection of the conjunctiva is now moderate and the individual vessels can be seen. 3.8.20.—Eye very much better; patient states that his vision is very much better; joints painless. Seen by eye specialist—Report: "This man has got extensive posterior synechiæ and deposits on lens capsule right eye following irido-cyclitis." Transferred to eye ward and discharged to duty. 15.9.20—Vision right eye 6/6; left eye 6/6.

Case V.—Case of iritis without joint involvement. *History*—Contracted gonorrhœa February 1920; double iritis developed in

April while discharge was still purulent; two months sick; no arthritis; iritis in left eye developed 20.7.20; no discharge.

Admitted 28.7.20.—Iris fixed; conjunctiva very hyperæmic; vision dim; throbbing pain in left eyeball; electrargol 10 c.c. given. 29.7.20.—Injection of conjunctiva has all but disappeared; a faint circumcorneal salmon pink ring still persists; throbbing pain has gone. 2.8.20.—Report from eye specialist—"This man must have had a severe irido-cyclitis left eye. There are posterior synechiæ present with some deposits on anterior lens capsule and also remains of exudate into anterior part of vitreous which is muddy. All active inflammatory signs have disappeared." 6.9.20.—Patient has not relapsed and is fit for duty.

Case VI.—Case of metastatic conjunctivitis.

Eight weeks after infection patient developed a severe purulent conjunctivitis with intense œdema of the lids, photophobia, throbbing pain in the temple, and hot flushings in the right eye. There was no urethral discharge. A few days later the left eye followed suit. Smears from the eye showed no gonococci and the only organism grown was a white staphylococcus. Patient got no sleep at night and was extremely depressed.

1.12.20.—Electrargol 5 c.c. 2.12.20.—Patient slept all night; throbbing has diminished and the hot flushings have entirely gone; electrargol 5 c.c. 3.12.20.—Discharge is decreasing rapidly, and the symptoms are ameliorating; daily electrargol 10 c.c. was then given, and on the 8th December there was no discharge, nor pain, nor photophobia. Local treatment—Saline only. Eye shades.

A further eye condition which occurs commonly in gonorrhœa coincident with joint infection is hyperæmia of the conjunctiva without exudate or œdema of the lids. One eye is commonly affected but both may be involved. Three such cases occurred in this series of 30 cases and the administration of electrargol caused immediate disappearance in all three cases. For this type of case Surgeon Commander S. F. Dudley, M.D., Royal Navy, has suggested the name "toxic conjunctivitis of gonorrhœa" to distinguish it from the much less common condition of metastatic conjunctivitis.

Conclusions. — In all cases of the arthralgic and poly-arthritic types of gonorrhœal rheumatism, and in all eye sequelæ electrargol in 5—10 c.c. doses appears specific in relieving pain and reducing inflammation.

In chronic hydrarthrosis the results were less convincing. Pain was relieved, but peri-articular œdema persisted in spite

of the fact that joint effusion diminished. Relapse of joint effusion was the rule, if electrargol was discontinued. Probably the more conservative method of applying Scott's dressing to the joint yields better results.

The boon of sleep and the reduction of the slightly raised temperature to normal or subnormal ameliorated the patient's physical condition.

The bad effects of electrargol are ephemeral. I have given intramuscular injections to a man of 67, and intravenous injections to another aged 59 with no ill effects whatsoever.

A course of 2 × 5 c.c. and 2 × 10 c.c. is ample for the average case of gonorrhœal rheumatism. Thereafter the continuance of prostato - vesicular massage and vaccine therapy will complete the cure of the genital focus.

REFERENCES.—[1] Debre and Paraf, *Bull. Soc. Med. Hôpit de Paris.* [2] M'Donagh, *Practitioner*, January 1920. [3] Levy, Bing, and Duroeux, *Annales des Maladies Vener*, 1919, vol. xiv., p. 655. [4] Stern and Ritter, *Med. Rec.*, 1920, vol. xcvii., pp. 190-1. [5] Mukerjee, *Indian Med. Gazette*, September 1919, p. 338. [6] Fraser and Duncan, *Lancet*, 1920, vol. i., p. 248. [7] Harrison, *Lancet*, 1919, vol. i., p. 219. [8] Miller and Lusk, *Journ. Amer. Med. Assoc.*, 1916. [9] Reenstierna, *Journ. Amer. Med. Assoc.*, 21st August 1920, p. 578. [10] Nolf, *Journ. Amer. Med. Assoc.*, 22nd November 1919, p. 1579. [11] Schulman, *Med. Rec.*, 10th July 1920, p. 47. [12] Trossarello, *Journ. Amer. Med. Assoc.*, 26th June 1920, p. 1802. [13] M'Donagh, *Venereal Diseases*, 1920. [14] Finger, *Die Blennorhagie der Sexual Organ*, 1905.

SOME UNSOLVED PHYSIOLOGICAL PROBLEMS IN GYNÆCOLOGY AND OBSTETRICS.*

By R. W. JOHNSTONE, C.B.E., M.D., F.R.C.S. Ed.

I HAVE chosen this subject for my address for two reasons. In the first place, I wish to remind you of the great dependence of those of us who are clinicians upon those of you who are, or are going to be, laboratory workers and researchers. Secondly, I want to draw your attention particularly to some of the many gaps in our knowledge of the physiology of the reproductive organs in woman. At the outset, I would like to acknowledge to you the debt which we gynæcologists and obstetricians already owe to workers in this Physiological Department of the University of Edinburgh. Some years ago Dr F. H. A. Marshall worked in this Department and his presence was a great stimulus to the study of the physiological problems associated with reproduction. I have always regretted his departure for Cambridge, for he was ever most generous in placing his vast knowledge at the disposal of his colleagues, and ready to help in the elucidation of difficult points. While he was in Edinburgh, Marshall accomplished a great deal of important work, and in association with him Jolly, Lochhead, and Cramer all devoted some of their time to the physiology of reproduction, with the result that Marshall was able to produce a text-book on the *Physiology of Reproduction*, which is undoubtedly a masterpiece, and is still the most comprehensive work of its sort in existence. Not only so, but, as you are aware, the work of Sir Edward Sharpey Schafer on the ductless glands has in many respects thrown a flood of light upon problems which meet us clinically as gynæcologists. There is, therefore, a certain propriety in my attempting to focus your attention for a short time on some of those problems in the physiology of reproduction which still remain unsolved.

Menstruation.—I doubt if there is any bodily function in the female which has received more attention from time immemorial than menstruation, and yet we are still groping in regard to the actual cause and the precise significance of it. Its very mysteriousness has led to its becoming surrounded by encrusted masses of superstition and folklore which have, as

* An Address delivered before the Edinburgh University Physiological Society, 9th January 1922.

Novak says in his recent book, "befogged the subject in the minds of both the laity and the profession and inhibited intelligent efforts to study it." A whole lecture could easily be devoted to those superstitions alone without doing more than touching the mere fringe of the subject. Within the last half century, however, some real progress has been made, particularly in the last twenty years. That progress has been mainly along two or three lines, each of which has its particular fascination.

The great basal fact upon which this progress is founded is that the ovary is the source of the stimulus which keeps the menstrual cycle in motion. Probably the ovary unaided is not enough. We know now how almost inextricably interrelated all the endocrine glands are, and it is probable that it is the ovary acting, as it were, as the regulating Minister of Reproduction under a Coalition Cabinet of the pituitary, thyroid, suprarenal, and other glands, with which we have to deal. Another fundamental fact which was demonstrated by, amongst others, Marshall and Jolly in this Department, is that the stimulus is a blood-borne, and not a nervous one. This was proved by showing that menstruation continued normally even after complete removal of both ovaries, provided suitable grafts of the ovary were planted in some other portion of the body wholly independent of any nervous connection with the uterus. This is a physiological experiment which nowadays we are repeating occasionally for therapeutic purposes, when operating on diseased ovaries. Indeed, to such a height of perfection have some operators brought the practice of ovarian grafts, that claims have been made of subsequent pregnancy occurring. Some years ago Morris of New York reported that he had planted a graft of a healthy ovary of one woman in the abdomen of another and childless woman whose ovaries he had to remove on account of disease. The second patient and her husband were very anxious to have a child and very distressed at the necessity for the removal of both ovaries. Morris accordingly grafted a portion of the other patient's ovary in such a situation that if it continued to function it would be possible for the ova to reach the Fallopian tube. In the fulness of time this second patient is said to have conceived, and interesting questions arise as to which of the two women is the mother of the child—the woman who contributed the ovum, or the woman in whose uterus the fertilised ovum grew.

One of the lines along which the essential connection between the ovary and menstruation may ultimately be traced is that of comparative physiology. The periodicity of menstruation not unnaturally suggested the analogy with the periodic phenomenon of œstrus or "heat" in lower animals. This analogy has been most carefully studied by Heape amongst others, and without going into the details of the matter I may just quote Heape as the authority for the view that the stage of actual menstruation is analogous to the stage of pro-œstrum in the lower animals, during which there is intense congestion and in some animals actual discharge of mucus or blood from the genitalia. Heape's conclusions, which are very far-reaching and illuminating, are now generally accepted; and if correct they provide every encouragement to the prosecution of experimental research in animals as to the exact nature of the stimulus causing the œstrous cycle.

The second great line of research has been the attempt to trace the hormonic connection between the ovary and the uterus. The ovary, as you are aware, is even more complicated in the periodicity of its functions than the uterus. You will recall that the cortex of the ovary contains Graafian follicles in various stages of development embedded in a delicate connective-tissue stroma, throughout which in the human being are scattered isolated epithelioid cells. These cells are generally taken as being analogous to the so-called interstitial cells of Leydig in the testicle. In certain of the lower animals they occur in more definite aggregations, and Limon and Bouin have bestowed upon them the title of "the interstitial gland of the ovary." It is believed by many observers that these cells are probably the source of an internal secretion. Another internal secretion is supposed to originate in the Graafian follicles, one of which comes to full maturity every four weeks during the active sexual period of a woman's life, except during pregnancy and in most cases during lactation. When fully matured the Graafian follicle ruptures on the surface of the ovary and the ovum escapes into the peritoneal cavity, from whence it finds its way into the Fallopian tube. Such an ovum is mature and ready to be fertilised if it comes into association with a spermatozoon. It certainly seems not at all improbable that some internal secretion may be formed by the lining cells of the Graafian follicle during this periodic process of maturation and ovulation.

But an even more curious periodic series of changes follows the occurrence of ovulation. The now empty follicle becomes what is known as a corpus luteum. Either the lining cells of the follicle (the membrana granulosa) or, as I believe more probable in the human species, the stroma cells immediately surrounding the follicle (the tunica interna) become modified into large epithelioid cells filled with granules of a golden yellow lipoid known as lutein. These cells proliferate rapidly and form a festoon-like layer around the little central blood-clot of the empty follicle; in the course of ten days or so this layer becomes highly vascularised, and the appearance and arrangement of the lutein cells is strikingly reminiscent of the adrenal cortex, and highly suggestive of its being in fact a gland of internal secretion. As you are aware, this is now the interpretation which is generally accepted of the curious transmogrification which I have outlined, and a great deal of work has been based on the assumption that the corpus luteum is a ductless gland which is constantly renewed every four weeks. After a short period of maturity the corpus luteum undergoes retrogressive changes and slowly disappears. The retrogression is followed by the rupture of another follicle either in the other ovary or in another portion of the same ovary, which again in its turn becomes a corpus luteum—and so the cycle repeats itself. Now I wish you to observe that during the active sexual period of a healthy woman's life there are two regular, periodic cycles of changes going on in the pelvis—the one is this cycle of ovulation followed by the development of a corpus luteum taking place in the ovary; the other is the cycle of changes which take place in the uterus in association with menstruation. As I have indicated, it is only during pregnancy and lactation that these changes are in suspension, and when pregnancy occurs the life history of the corpus luteum is modified to this extent that the corpus luteum becomes larger than usual, persists in a stage of more or less complete maturity during the early months of pregnancy, and undergoes a slow retrogression during the latter months—its whole life history occupying some ten months as contrasted with some four or five weeks. Much research is now being devoted to the attempt to correlate the changes in the uterus with those in the ovary—a matter of very considerable difficulty when you consider the paucity of available human material in regard to which a sufficiently accurate history can be obtained. The series of changes in the lining endometrium of

the uterus has been very fully worked out, and may now be said to be definitely established. There are four stages each month. There is, first, the stage of pre-menstrual congestion, followed in the second place by the stage of menstruation proper when bleeding takes place from the surface of the endometrium. This is succeeded thirdly by the post-menstrual stage of involution or repair, and that in turn gradually subsides into a fourth short quiescent or resting stage. Another pre-menstrual congestion then begins, and so on the cycle goes. The life history of the corpus luteum has also been mapped out into four stages, but not yet with quite the same degree of certainty. According to Fraenkel, Meyer and others, the stages are those of proliferation of the lutein cells, vascularisation of the lutein layer, maturity of the corpus luteum, and, lastly, retrogression.

The point, now, is this—is there a clear parallelism between the menstrual cycle in the uterus and the corpus luteum cycle in the ovary? If so, it would go far to indicate that an internal secretion from the corpus luteum that is directly associated with the cause of menstruation.

To establish any clear chronological parallelism is by no means easy, because in the human being we know not the day nor the hour when ovulation occurs. Observations based upon operative and post-mortem findings indicate that in all *probability* ovulation in the human female occurs somewhere between the fifth and fourteenth days following the commencement of the menstrual period. If we accept that, there would appear to be evidence that a proliferating corpus luteum is present when the endometrium begins to show the preliminary signs of pre-menstrual congestion; a mature corpus luteum during the more pronounced pre-menstrual congestion stage; and a retrogressive corpus luteum during the menstrual and post-menstrual stages. If this be substantiated it would suggest that the internal secretion of the corpus luteum is the stimulus to the congestion of the endometrium which leads up to menstruation, and that the commencing retrogression of the corpus luteum with, presumably, an associated cutting off of its internal secretion, is associated with the depletion of the engorged endometrium in the actual menstrual flow. In the event of pregnancy occurring, something unknown happens which preserves the corpus luteum from retrogression and also inhibits the occurrence of menstruation. Presumably this unknown factor arises from the fertilised ovum.

Such is the modern luteal theory of menstruation, whose principal sponsor is Fraenkel. It is by no means universally accepted—it is too speculative as yet; but I have outlined it to you in order to point out the many gaps in our knowledge which we look to physiologists to fill up in the future.

Before leaving the corpus luteum, I may say that this supposed function in connection with menstruation does not by any means exhaust the activities attributed to it. If it stimulates the pre-menstrual congestion, it is probably also concerned in the production of the decidual reaction in the endometrium in early pregnancy—that curious change in the lining mucosa of the uterus which is characterised by a transformation of the stroma cells into giant epithelioid cells, whose function is believed to be to protect the blood-vessels and other maternal structures against the destructive properties of the young ovum. Further, there is some evidence that its presence is necessary to the safe continuance of pregnancy in the early months, and that it originates and controls the hypertrophy of the uterus to contain the growing ovum. This last view is based upon the effects of experimental destruction or removal of the corpus luteum in animals during early pregnancy. Recently I had an experience which may be held to support it. A few weeks ago I had occasion to operate within one week on two women, each three months pregnant. From the one I removed an ovarian cyst as large as a fœtal head; the other ovary was healthy and contained a large corpus luteum which I demonstrated to the students. From the other patient I removed an ovarian cyst of almost identical size, but I found that the other ovary had been removed at a previous operation in England, the nature of which was unknown to the patient. On examination this latter cyst was found to contain a corpus luteum flattened out on the cyst wall. The operations were identical in both cases; both patients made good recoveries; but the second one aborted on the fifth day. So far as it goes, this may be taken to be the result of my having accidentally removed the corpus luteum, but on the other hand it might be merely a miscarriage resulting reflexly from the trauma.

The cause of menstruation is by no means the only interesting problem concerning it which awaits solution. Here is another question: There is no other physiological or pathological state of congestion in which there is a similar

or even a comparable passage of blood corpuscles from the blood-vessels into the surrounding tissue by diapedesis. This argues almost certainly a local factor in the endometrium, and my friend and colleague Young maintains that there is an active process of imbibition on the part of the stroma cells which explains how the fluid and later the corpuscular elements of the blood are drawn out through the capillary walls.

Again, menstrual blood is different from ordinary blood in certain respects. One peculiarity is that normally it never clots, no matter how long it may be kept. In certain conditions of congenital atresia—for example, in the lower part of the vagina — menstruation goes on behind the obstruction and menstrual blood may accumulate in large quantities from month to month and year to year, until ultimately it may be allowed to escape by means of operative interference. The blood from such a hæmatocolpos, as it is called, escapes as a thickish, chocolate-coloured fluid, and if it be collected in a bottle it will remain fluid for as many years apparently as you like to keep it. The same persistent fluidity is characteristic of fresh menstrual blood in normal circumstances. Blair Bell has shown that the blood from such a hæmatocolpos possesses a great excess of calcium, and according to certain observers no fibrin ferment is present. Other observers believe that fibrin ferment is present. The excess of calcium is regarded by Blair Bell as indicative of the casting out of the system of material which gradually accumulates each month against the needs of a growing embryo in the event of pregnancy occurring. Certainly the calcium metabolism in woman is much more unstable than in man, and there is much evidence to support the view that it is governed by the influence of the ovary in conjunction with the other ductless glands, and that it is thus governed with an eye primarily to the needs of the reproductive situation. What I mean is this: Nature's greatest interest in woman is in her relation to the reproduction of the species. Every month during the active sexual period preparation is made for the upbuilding of a fœtus, in the event of the ovum set free during that month becoming fertilised—preparations, firstly, in the accumulation of calcium salts in the mother's body, and secondly, in all probability, in the two periodic cycles of the corpus luteum and the changes in the endometrium which we have been studying. If no pregnancy occurs the calcium accumulation is expelled in the

menstrual blood, the corpus luteum disappears, and the endometrium subsides into a quiescent condition. If pregnancy does occur the corpus luteum persists, the pre-menstrual congestion goes on to the decidual reaction, and the calcium accumulation is devoted to the building up of the child. Note further that when a woman nurses her child the function of lactation also gives rise to a great demand for calcium, and in 60 per cent. of nursing women lactation is accompanied by the persistent cessation of menstruation—nature evidently economising in calcium.

From the clinical point of view it is of the first importance to try to get down to the truth in regard to the phenomenon of hæmorrhage from the uterus. Menstrual irregularities involving excessive blood loss are amongst the commonest of gynæcological symptoms, and up to the present we are frankly treating many of them in a way that is really empirical. The trend of modern work is to seek the reason of the non-coagulability of menstrual blood in the endometrium. Dienst maintains that the endometrium contains an antithrombin which counteracts the normal activity of the fibrin ferment. Cristea and Denk believe that the endometrium has the power of abstracting the fibrin ferment from the blood. Beckwith Whitehouse of Birmingham, again, believes that normal menstrual blood *does clot in the uterus*, and instances the fact that an intrauterine clot or coagulum is the rule in the proœstrum of the lower animals. That menstrual blood does not clot in the human species *after its escape from the uterus* he ascribes to the presence of a thrombolytic or fibrinolytic ferment in the endometrium. His experiments give no evidence of an antithrombin such as Dienst propounds, but on the contrary he demonstrated that the endometrial stroma has a very high thrombokinetic power which is apparently raised during menstruation. Clinically this can be easily demonstrated by the extraordinary rapidity with which the blood removed from the uterus along with scrapings of the endometrium during the operation of curettage undergoes coagulation. Whitehouse's view, in short, is that the menstrual blood forms a clot in the uterine cavity, which is subsequently acted upon and dissolved by a thrombolysin contained in the secretion of the uterine glands. Menstrual blood collected in the vagina or passed to the outside is therefore fluid and remains so.

Work along the lines I have indicated has, in combination

with clinical observation, led to a general belief that pathologically, uterine hæmorrhage, other than that associated with abortions, tumours, inflammation, or other gross lesion, may be the result either of conditions in the ovary affecting the nature or quantity of the ovarian internal secretion which controls the vascular condition of the uterus, or, of conditions in the endometrium affecting either its thrombokinetic or its thrombolytic functions. Thus some cases of excessive uterine bleeding respond to the operation of curettage, either permanently or temporarily, because the *fons et origo mali* was in the endometrium. Others, which do not so respond, yield to the removal of a hypertrophied ovary or to its diminution in size by resection. So far, however, our treatment is still in too many cases empirical, and we need, firstly, an accurate and substantiated knowledge of the factors concerned in uterine hæmorrhage, and secondly, a means of recognising which factor is at fault in any given case.

The Onset of Labour.—Another problem to which I would venture to ask your attention is this—Why does parturition ensue after a lapse of forty weeks? As you are all aware, the period of gestation varies greatly in different species of animal, but within the species there is what one may call a set period at the end of which the uterus casts off its contents. It is, of course, recognised that in exceptional cases pregnancy may be shortened or prolonged within limits consistently with the development and birth of normal offspring, neither under- nor over-developed. But such exceptions, although of great interest, and in the human female of occasional medico-legal importance, do not affect the general rule.

If you look up any reasonably full text-book on Midwifery you will find that some ten or twelve views as to the cause of the onset of labour are mentioned. Several of these may probably be discounted at once without fear of error. Of the remainder we find that some observers regard it as due to the increasing distension of the uterus associated with an increasing susceptibility to reflex stimulus and an increasing strength in the intermittent waves of contraction which pass over the uterus from time to time. Others seek the cause in certain senile changes which normally occur in the placenta and decidua—structures designed for a brief span of existence—which tend to loosen the attachment of the ovum to the uterus.

Experiments have shown that in a uterus severed from all connection with the central nervous system labour ensues at the usual time and progresses normally in its motor aspects. It is, therefore, obvious that the onset of labour must be due to stimulation of the essential ganglia in the uterus itself by blood-borne substances or by substances coming from the ovum itself. It has been suggested that the latter produce labour by a process of anaphylaxis—the mother is supposed to be supersensitised to fœtal products in minute quantities during pregnancy, but at the end of gestation the fœtal antigens pass over in such great quantity that the reaction between them and the maternal antibodies causes the uterus to pass into labour. An anaphylactic theory of this sort was almost inevitable in view of the interest aroused in the profession by the discovery of anaphylactic reactions, but it lacks confirmation. More support is available for the view that the stimulus is either an ovarian hormone, or some substance formed during the altered metabolism of the mother in the later weeks of pregnancy. Slemons and others have recorded definite alterations in the maternal metabolism just prior to the onset of labour—for example, a considerable and apparently sudden diminution in the output of nitrogen through the urine. Lastly, in view of the tremendously potent effect which the internal secretion of the posterior lobe of the pituitary has upon the uterus along with other unstriped muscles, it is impossible to rule that gland out of account in this connection. Watson of Toronto has shown that the repeated injection of pituitary extract at short intervals of about half an hour does, in some cases, succeed in inducing labour pains—but it is significant that success was more frequent the nearer the patient was to her full time. Here, then, is another field for research, and you will realise that accurate knowledge of the cause of the onset of labour would be of great practical value inasmuch as it would be a step to a truly physiological method of inducing labour. Properly safeguarded from abuse such a method would be of the highest value in obstetrics in those cases where it is necessary to bring on labour prematurely, and from the point of view of the practitioner and obstetrician it is an ideal to dream of, that some day we may be able to give a patient who has reached her term a tabloid which will ensure labour starting and probably finishing on a convenient day and at a reasonable hour!

The Placenta.—Another field for research which promises a

rich yield of profitable fruits is the *placenta*. It is strange how little is known for certain in regard to the physiology and pathology of that organ. That it is an amazing metabolic microcosm we know, but the intricacies of its working are still in great measure the subject of speculation. To begin with, there is that astonishing fœtal tissue the trophoderm—including both the syncytium and Langhan's cells—with its extraordinary power of digesting other tissues. The trophoderm is a tissue *sui generis*. In the young ovum its presence and its functions are purely physiological; and yet in a chorionepithelioma we see exactly the same tissue imbued with the most malignant cancerous characters, and all the time changed in no histological particular. Except that it does not change its appearance the physiological syncytium and the syncytium of a chorion-epithelioma are the veritable Dr Jekyll and Mr Hyde of human tissues.

With regard to the metabolic changes that go on between the mother and the fœtus through the medium of the placenta there are two main views, neither of which is as yet quite firmly substantiated. So far as the passage of diffusible crystalloid substances like sugar and salts is concerned, there is no great difficulty, as it can be explained by a process of osmosis, diffusion, or filtration through the placenta. Such is the so-called *mechanical* theory. But much greater difficulty is encountered in connection with non-diffusible colloid substances, such as fats and proteins. I need not weary you by going into details; suffice it that, according to the *vitalistic* theory, the trophoderm is believed to be endowed with selective powers which enable it to pick out requisite substances from the blood and pass them to the fœtus or *vice versa*. Herein we have a wide field for research which has a very important bearing on the welfare both of the mother and of the child.

Ante-natal Physiology.—This brings me naturally to a brief consideration of the subject of ante-natal physiology. Here lies a particularly romantic tract of country awaiting the explorer. Difficult of access, and in many respects unique, it is the Thibet of human physiology with forbidden and sacred strongholds, and hitherto unscaled summits of knowledge awaiting your conquest. Have you ever read Feldman's *Ante-natal and Post-natal Child Physiology?* If not, you will find it stir your researcher's instincts as an incomplete map fires the

imagination of the explorer. It is no reflection on Feldman's book to say that it is as inspiring because of what it does not, and, in the present state of our knowledge, cannot contain, as it is absorbing for what it does expound. There is a question either explicit or implicit on every page. As I drafted this address I opened the book at random, and the first question that leaped to the eye was this, "Does the fœtus live in a state of symbiosis with, or as a parasite on, its mother?" Or, to put a very similar question in another way, "Does the mother build up the infantile organism exclusively from the material which she derives from her food, or does she supply to the child material from her own tissues?" On the answer to that question depend large issues of great clinical importance concerning both the pregnant woman and the unborn babe. The whole question of the so-called toxæmia of pregnancy is bound up with this other question—and while the general trend of opinion favours the view of a harmonious symbiosis, there are evidences such as, for example, Abderhalden's serum reaction, which suggest a certain parasitism. Again, the question of proper diet in pregnancy is involved in the answer—and, in short, a large proportion of the answer to another great question of vital moment to us as a nation, namely, how to secure a new generation of healthy infants from mothers who are often in the lower categories of fitness.

Turning over a few more pages, I came on another question which is full of romance. What is it that makes the new-born infant draw its first breath? Is it that, as King Lear says,

> "When we are born, we cry that we are come,
> To this great stage of fools,"

or is it merely a cry of grief at passing from the comfort of intra-uterine existence into this vale of tears? Is the respiratory centre stimulated by sensory stimuli from the skin, or is it stimulated by the increasing venosity of the blood? I have no doubt that the lives of many children now lost at the moment of their birth, in spite of all our efforts, will reward the physiologist who can give us an exact answer to this question and devise the real physiological remedy for apnœa neonatorum.

Lactation.—And now before closing I would ask you to lift up your eyes and behold yet one more land of promise to the humane physiologist. (I spell it with an "e" this time, as it

connotes much of the beneficent results of exploration that are in my mind.) I refer to Nature's provision of food for the new-born child. All our science and all our art have not yet provided a substance so good as the mother's milk. Yet how little we know about it! I believe physiologists are not yet determined as to whether breast milk is really a secretion or not. Certainly we have no proved knowledge as to the cause of its sudden appearance in the breasts, and little knowledge as to the conditions controlling it either in quantity or quality. Why is true milk never secreted as long as the child is in the uterus? After a woman has had a child, and has nursed that child, small quantities of milk frequently remain in the breasts, and may be expressed on pressure for months or years subsequently, but as soon as that woman becomes pregnant again the milk disappears from her breasts once more. True, an oily fluid—colostrum—appears in the breasts during pregnancy, but no true milk until some seventy hours after the infant's birth. Of recent years the answer to the question has been sought in the influence of various hormones on the mammary glands, and the work of Miss Lane-Claypon and Professor Starling has received much attention. These observers proved that the stimulus is blood-borne and not nervous. They further thought that the characteristic growth of the mammæ during pregnancy is due to "a specific chemical stimulus produced in the fertilised ovum." Lactation or the appearance of true milk in the breasts they attributed to the removal of this substance, and they further regarded it as "exerting an inhibitory influence on the gland cells, hindering their secretory activity and furthering their growth." It would appear, however, that fœtal hormones are not alone in producing such effects. Similar results have been obtained by the injection of other extracts—in particular extracts of the corpus luteum and of the placenta. Why do the lower animals eat their placentas? Is it a natural instinct to stimulate the secretion of milk which in them is present in the mammary glands much sooner after delivery than in the human female? And is the long interval of seventy hours between delivery and the appearance of the milk in the human female connected with the deprivation of this natural stimulus by a more refined civilisation? Clinical observations on the administration of placental extract are conflicting, although certain American authors have claimed considerable success.

Such few clinical observations as I have had an opportunity of making on this point were unconvincing; in two cases out of three the quantity of milk was increased. But it is open to argument whether other extracts might not have had a similar effect, and whether the effect may not have been due to the influence of suggestion.

But for the sake of that generation of A1 infants, we want an answer to these questions and also to the problem of how to improve the milk both in quantity and in quality. Healthy babies may now be reared on substitutes for their mother's milk, thanks to clinical and physiological research. That is a step of enormous life-saving importance. But even the most ardent advocate of such substitutes and the most pushing proprietors of patent foods admit that no substitute can ever hope to equal the natural mother's milk.

CRITICAL REVIEW

THE COMPLEMENT-FIXATION REACTION IN TUBERCULOSIS.

By A. NIMMO SMITH, M.B., Ch.B.,
Clinical Pathologist, Deaconess Hospital, Edinburgh.

(*Continued from p.* 179.)

III. The Complement-Fixation Test in Relation to the Stage of the Disease, and to Active and Inactive Lesions. (Table I.).—The frequency with which a positive complement-fixation reaction is obtained in the sera of those with a tuberculous infection varies according to the stage of the disease, and also in accordance with the state of activity or inactivity of the lesion.

TABLE I.—*Showing percentage of Positive Results in relation to the Stage of Disease.*

	Antigen.	Per cent. Positive.			No. of Cases.
		Early.	Moderately Advanced.	Far Advanced.	
Craig .	Filtrate of culture of tubercle .	60·0	85·8	96·4	166*
	Bacilli after extracting with alcohol	81·8	88·2	96·6	209†
Moon .	Suspension of ground tubercle bacilli	87·5	85·7	84·3	156
		Stage I.	Stage II.	Stage III.	
Miller .	Suspension of ground tubercle bacilli	100·0	96·8	95·6	284
Radcliffe	Emulsion of living tubercle bacilli	88·6	89·6	79·3	467
Caulfield	Bacillary emulsion (Koch) .	33·0	70·0	62·0	102

* 1915. † 1917.

Attempts have been made by some workers to determine the results of complement-fixation tests in various stages of the disease, and accordingly patients have been grouped into three main classes, as:—1. Early or incipient; 2. Moderately advanced; and 3. Far advanced. It is obvious that in many instances a patient placed in one category by one clinician might readily enough have been considered as belonging to another class by a second clinical observer,

In some cases the Turban classification has been used.

Craig[18] has analysed his results in two different investigations undertaken by him in pulmonary tuberculosis, and has tabulated his results in relation to the class of infection, and to the state of activity or inactivity of the lesions.

In his first series of 166 cases, he found 96.2 per cent. positive among those classed as having active lesions, while of those whose lesions were inactive 66.1 per cent. gave a positive reaction.

Of those grouped in the incipient class 60 per cent. were positive; in those in whom the process was moderately advanced, the percentage of positive results was 85.8 per cent., with 96.4 per cent. in the group having far advanced disease.

In his second series, which comprised 209 cases, those with active foci gave 96.6 per cent. positive fixations, and those with inactive lesions yielded 65 per cent. positive results.

In this series the incipient group produced 81.8 per cent. positive, the percentage of positive reactions in the moderately-advanced and far-advanced groups being 88.2 and 96.6 respectively.

Patients having active lesions in each class, as a rule, showed a higher percentage of positive tests than those in whom there was no clinical evidence of activity, except that in both series the inactive far-advanced cases gave 100 per cent. positive results; the numbers in this group, however, were small.

Caulfield,[27] using as his antigen bacillary emulsion, grouped his cases according to the Turban classification, and found his percentages of positive reactions to be 33 in Turban I. cases, 70 in Turban II. cases, and 62 in Turban III. cases.

Radcliffe[9] also grouped his cases according to the Turban classification; 88.6 per cent. were positive in Group I., 89.6 per cent. in Group II., and 79.3 per cent. in Group III.

Miller[11] divided his 397 cases of pulmonary tuberculosis into active and inactive, those with active lesions giving 275 positive reactions out of 284 cases, while of 113 patients with inactive lesions only 10 were found to give a positive complement-fixation test.

He further classified the active cases as follows:—

(1) Incipient, with 109 per cent. positive results.
(2) Stage I., cases with 100 per cent. positive.
(3) Stage II., cases with 96.8 per cent. positive.
(4) Stage III., cases with 95.6 per cent. positive.

In Moon's[12] cases the percentage of positive reactions in the incipient class was 87.5, in the moderately-advanced class 85.7, and in those classed as far advanced the percentage was 84.3.

In another set of observations,[28] only 2 out of 22 inactive cases gave positive reactions, while 34 out of 39 active cases gave positive tests, and of 37 patients classified as having advanced lesions,

34 were found to give positive reactions. In contrast to these results, Moursund,[29] examining 103 patients in whom the disease was active, found that only 15.5 per cent. gave a positive complement-fixation reaction. Of the cases in the inactive class, 51 in all, 50 gave a negative reaction, while 1 gave a positive, but this patient was also positive to the Wassermann test.

IV. Quiescent and Arrested Cases.—Not infrequently the complement-fixation test has been found to be positive in cases which were clinically quiescent at the time of the test. Since the test depends upon the presence or absence of demonstrable complement-fixing antibody in the blood, and as this antibody is produced in response to the stimulus of an active tuberculous lesion, it would seem that those cases in which the test was positive, although they were apparently quiescent, either had a focus which was pathologically but not clinically active, or else the focus, while arrested at the time the test was made, had been active recently, the antibodies not yet having disappeared from the blood.

This seems to be a reasonable supposition, and is in keeping with the persistence of various antibodies in the blood of patients who have recovered from other diseases.

In the series of cases whose complement-fixation reactions were examined by Dudgeon, Meek, and Weir,[7] there were 19 who were classed as arrested, and whose conditions had been quiescent for periods of from several months to seven years, but in 14 of these cases positive fixation results were determined.

Neuman and Stoll[21] investigated 17 old tuberculous patients, showing no evidence of acute tuberculosis at the time of the test, and found that 6 per cent. gave positive complement-fixation. They were of the opinion that a positive reaction in patients showing no signs or symptoms did not justify a diagnosis of active tuberculosis, although it was quite probable that there had been an active focus recently.

Miller[11] found that, in arrested cases, the percentage of negative results was 91.

Craig[18] holds the view that a case, although clinically inactive, cannot be considered to be *cured* as long as the complement-fixation test remains positive, as a positive reaction means an active focus somewhere in the body; he considers that the test will prove of the greatest value in discriminating really *cured* infections from those which are merely *quiescent*, at least 80 per cent. of his cases classified as inactive moderately advanced, although quiescent or cured clinically, giving 68.7 per cent. positive fixations, subsequently relapsed clinically.

V. Relation of Strength of Reaction to Clinical Condition.—Attempts have been made to correlate the strength of the reaction with the clinical condition of the patient, in the hope that by this means

an indication might be furnished of the patient's resistance to the tuberculous infection, and some help gained in prognosis.

This hope has not been realised, and no very definitely conclusive results have been attained. Sometimes positive and sometimes negative results occurred in patients presenting no signs or symptoms of an active infection and whose general condition of health was good; and, on the other hand, strongly positive or negative reactions were presented by patients whose condition was bad and in whom the disease was far advanced; not uncommonly negative reactions were given by patients who were dying, and whose deaths took place shortly after the serological examination.[4, 25] Patients presenting the same clinical phenomena often behaved quite differently as regards their serological reactions: thus some cases showing evidence of considerable toxæmia gave a slight reaction, while cases in all respects the same as those from the clinical aspect gave strongly positive reactions; and, on the other hand, a strongly positive reaction might be found in a chronic fibroid case apparently in good condition.[7]

Meek[30] found that the strength of the reaction may change very considerably without any change in the patient clinically, and that, on the other hand, definite signs of extension of the pulmonary lesion may not be accompanied by any change in the strength of the complement-fixation reaction.

The weakening of a positive reaction to a weakly positive or to a negative is regarded as a good prognostic sign by von Wedel,[31] in incipient and moderately-advanced cases showing improvement clinically; this same change occurring in far-advanced cases in poor condition, he regards as a bad prognostic sign. Other observers have also recorded a weakening in the strength of the reaction coincident with rapidly failing resistance.[13]

It cannot be said that the strength or intensity of the complement-fixation reaction supplies any criterion of the power of resistance of the patient, and it cannot be relied upon as a guide in prognosis.

VI. The Complement-fixation Reaction in Tuberculosis other than Pulmonary.—The complement-fixation reaction has been applied to other forms of tuberculous infection, and tests have been made by various observers with the sera of patients presenting such tuberculous conditions as lupus, adenitis, Pott's disease, joint infections, meningitis, and peritonitis.

The sera of 104 cases of lupus were tested,[32] the patients having had the disease for periods varying from ten to forty years, the ages of the patients varying from 10 to 74 years. In these cases the skin lesions were the only clinical evidence of tuberculosis.

In this series of cases 66.4 per cent. gave a definitely positive reaction, while a "partial" positive was found in 17.3 per cent.

Grouping together cases of tuberculous infection of bone, Pott's disease, etc., Fried [25] found the reaction positive in each of 22 patients examined; again, with Goldenberg,[26] he examined 11 similar cases, and found that all of them gave positive reactions.

In a number of cases of Pott's disease, tuberculous glands, tuberculous disease of knee and hip joint, Mozer and Fried [33] made the observation that these lesions, when in the stage of development, lead to the production of a higher percentage of positive results than do those which are healing, and that the lowest percentage of positive reactions is manifested by those patients in whom fistulae are present, and whose general condition is not good.

In tuberculous meningitis Besredka [15] failed to find any complement-fixing antibodies in the blood of 12 children, but Miller [11] records 4 cases of this type of infection, 3 of which gave a positive fixation test.

VII. Value of the Complement-Fixation Test in Diagnosis.—To be of real diagnostic value, any serological test must fulfil the following requirements:—

1. It must be negative in healthy people who are free from the disease in question.
2. It must be negative in persons suffering from some disease other than that to which the test is applicable.
3. It must be positive in the great majority of cases of the disease for which it is claimed to be specific.

Many observations have been made as to the behaviour of the sera of normal people as regards any power of fixing complement in the presence of a tuberculous antigen.

If such non-specific fixation were to occur with any degree of frequency, the complement-fixation reaction would be worthless as a means of diagnosis of the presence of tuberculous infection. Here, again, different investigators report very different results.

Craig (1915) [18] examined the serum in 150 normal individuals, and stated that the test was negative with the serum of normal people. In a later report (1917) he met with one positive reaction in 200 young healthy soldiers free from any clinical manifestations of tuberculosis; the case where the reaction was positive subsequently developed night sweats and hæmoptysis, but tubercle bacilli were not found in the sputum. On the other hand, M'Caskey,[19] using Craig's antigen, found the reaction positive in 20 per cent. of non-tuberculous people.

Stoll and Neuman [21] applied the test to 40 healthy persons, all reacted negatively, while in 50 apparently healthy people examined by Woods [28] a positive reaction was given by 2.

Moon [12] reported 12 positive fixation reactions in 100 apparently healthy young adults; 2 of these were found to have physical signs

sufficient to class them as suspicious cases, but the others did not show any clinical signs suggesting tuberculosis. Among 23 patients with other conditions, not tuberculous, the test proved positive in 6 (26 per cent.). As a possible explanation of some of these reactions, Moon suggested that they might have been false positives due to an imperfect antigen. Using the same form of antigen, however, Miller[11] examined 144 cases clinically free from tuberculosis, some healthy and others with various conditions of disease, but none reacted positively.

Examining the reaction in diseases other than tuberculosis, M'Intosh and Fildes[9] found only 3 positive reactions in the 81 cases examined, and of the 3 positive, 2 were suffering from leprosy, and 1 was a case of Addison's disease.

Twenty healthy people examined by Wang and Crocket[22] were all negative. Watkins and Boynton[34] reported on 168 patients clinically free from tuberculosis; in 4.2 per cent. they record positive findings by the complement-fixation test.

The reaction was studied in children by J. V. Cooke,[35] who found that positive results were given in 5 per cent. of patients suffering from non-tuberculous conditions. He made the observation that a positive complement-fixation reaction might occur in a non-tuberculous patient who was suffering from diphtheria, or who had just recovered from this infection; all of his diphtheria cases giving a positive complement-fixation with the tuberculous antigen had received inoculations of antitoxin; similar results were obtained by Urbain and Fried[36] in cases of diphtheria, and in tests made in which the serum used was anti-diphtheritic serum. This was further corroborated by Negre and Boquet,[37] who found that extracts of the bacillus of diphtheria act as an antigen along with tuberculous antibodies.

The Complement-fixation Reaction for Tuberculosis in Serum giving a Positive Wassermann Reaction (Table II.)—It has been noted that in some cases a positive reaction may be obtained by this test for tuberculosis with the serum of a syphilitic patient where the Wassermann reaction is positive, and when no signs of tuberculosis are manifested by the patient.

Here, again, very different results have been obtained by different investigators, and opinions differ as to whether a positive fixation occurring with a tuberculous antigen and a serum giving the Wassermann reaction is an instance of non-specific cross-fixation, or whether it is evidence of the co-existence of syphilis and tuberculosis in the same patient.

In one report[14] 70.6 per cent. of the sera which were positive by the Wassermann test are stated to have given a positive tuberculosis fixation also; and in 75 sera from children with congenital syphilis Cooke[35] found both reactions positive.

TABLE II.—*Relation between Wassermann Reaction and Complement-fixation Test for Tuberculosis.*

	Antigen.	No. of Patients with Positive Wassermann.	Percentage of these, Positive by Test with Tuberculous Antigen.	
M'Intosh and Fildes	Emulsion of living tubercle bacilli	18	0	...
Miller . . .	Suspension in saline of ground tubercle bacilli	243	2·8	One had tuberculous peritonitis, and four had signs suggestive of tuberculosis.
Burns, Slack, Castleman, Bailey	Miller's antigen . .	221	19·9	...
Moon . . .	Miller's antigen . .	100	38·0	...
Corper and Sweany	(*a*) Miller's antigen . (*b*) Autolysate of tubercle bacilli	92	70·6	...
Craig . . .	Alcoholic extract of culture of tubercle bacilli	350	5·4	Four afterwards showed tubercle bacilli in sputum.
M'Caskey . .	Craig's antigen . .	25	44·0	...
Moursund . .	Alcoholic extract of dried, powdered tubercle bacilli	100	45·0	...
Cooke . . .	Saline suspension of an alcoholic precipitate of tubercle bacilli (dried and powdered)	75	100·0	Cases of congenital syphilis.
Von Wedel . .	Wilson's lipoid-free antigen	86	3·4	Two had symptoms of syphilis and tuberculosis.
Stoll and Neuman .	Wilson's lipoid-free antigen	228	4·8	Three found to be tuberculous.
Wang and Crocket .	Lipoid-free antigen .	100	41·0	...
Leredde . . .	Besredka's antigen .	42	64·2	Four definitely tuberculous, and seven suspicious.
Mozer and Fried .	Besredka's antigen .	14	50·0	...

Wang and Crocket,[22] employing a lipoid-free antigen, obtained a positive tuberculous complement-fixation reaction in 41 per cent. of the sera examined by them, which were also positive with the Wassermann antigen; also using an antigen prepared after extraction of tubercle bacilli with alcohol, Moursund[29] found that 45 per cent. of the syphilitic sera examined by him fixed complement in the presence of this antigen.

Even when the same form of antigen has been used by different workers their results have differed; thus Craig (1917), with an antigen which consisted of the filtrate of a culture of tubercle bacilli after treatment with alcohol, examining 350 syphilitic patients, each with a positive Wassermann, found that only 5.4 of them reacted in a positive manner with his tuberculous antigen, and some of those who reacted positively to both tests afterwards showed tubercle bacilli in the sputum.

M'Caskey used Craig's antigen, but found that both reactions were positive in 44 per cent. of the syphilitic patients examined; he only examined 25 cases, however.

Stoll and Neuman employed a lipoid-free antigen (Wilson's), and examined 228 persons in whom the Wassermann was positive; 11 of them reacted to both tests, and 3 of these were found to be tuberculous, leaving 3.5 per cent. possibly non-specific reactions.

The same antigen was used by von Wedel,[31] who found that only 3 cases were positive to both tests out of 88 sera giving a positive Wassermann, and in 2 of them symptoms of both diseases were present.

Contradictory results have been obtained by several workers using Miller's antigen.

With this antigen, Miller studied the reaction in 243 patients with positive Wassermann reactions, and in only 7 of these were both tests positive; 1 of the 7 was a case of tuberculous peritonitis, and in 4 of the others signs were present which suggested tuberculosis. In contrast to these results, Moon, using Miller's antigen, found that 38 per cent. of those with a positive Wassermann also gave a positive complement-fixation test with the tuberculous antigen, while other workers[13] employing this antigen report the occurrence of a positive result in 19.9 per cent. of syphilitics with a positive Wassermann.

Bass,[24] using Besredka's antigen, records the occurrence of complement-fixation with this antigen in 32 instances out of a total of 114 clinically non-tuberculous syphilitics.

In Craig's opinion, the occurrence of a positive Wassermann and a positive tuberculous fixation reaction in the same serum is not due to non-specific cross-fixation. He points out that there are many instances on record of the co-existence of syphilis of the lung with pulmonary tuberculosis. Others seek to explain the phenomenon by assuming

that in syphilitic patients the resistance to tuberculosis is lowered, and that they are therefore more prone to be successfully attacked and invaded by the tubercle bacillus.

On the other hand, it is difficult to accept it as a fact that 45 per cent. or more of syphilitic patients are suffering from an active tuberculous infection at the same time, without showing any clinical evidence of tubercle.

There seems to be very little room for doubt that with some of the various forms of antigen used, non-specific cross-fixation does occur with sera giving a positive Wassermann reaction, in patients where tuberculosis has been excluded as far as possible by clinical methods.

A positive reaction may also be obtained, both in apparently healthy people and in patients suffering from various diseases, even when no clinical evidence of tuberculosis is forthcoming. Some of these apparently non-specific reactions may possibly be explained by a tuberculous infection which, while not clinically active, is pathologically active, and is causing the production of antibodies capable of combining with the tuberculous antigen in the test and fixing complement. While this explanation might account for some of these anomalous results, it cannot account for all of them, and it seems that an uncertain number of non-specific reactions do occur.

It is most probable that the difference in the results of the various observers is due, in great measure, to differences in the technique adopted and to the variety of antigens employed.

The application of this test in the diagnosis of tuberculosis cannot be regarded as thoroughly reliable as the reaction appears under certain circumstances to be non-specific; at the same time, where the test is negative on repeated trials in the same individual, it may be assumed that the patient is non-tuberculous, or that a previously diagnosed tuberculous lesion has ceased to be active.

In a large number of cases where there is an active tuberculous focus the reaction is positive, and in a large number of cases which have presented signs of an active focus the reaction is found to be negative when the lesion has become inactive clinically.

It cannot be said that a positive complement-fixation test is conclusive evidence of an infection by the tubercle bacillus, nor that a negative test rules out with certainty the presence of such an infection.

Conclusions.—The position as regards the value of the complement-fixation test as a diagnostic procedure may be summed up as follows:—

1. In a clinically suspicious case, where the Wassermann is negative, a positive complement-fixation reaction is strong presumptive evidence of tuberculosis.
2. In a clinically tuberculous patient a positive reaction denotes activity of the lesion.

3. *Repeated* negative reactions may be taken to indicate either the absence of tuberculosis or that a lesion previously active has become inactive.

   A *single* negative is of little or no value in a clinically suspicious case.

4. The reaction may be negative in far-advanced cases dying of the disease.
5. A positive reaction is most likely to be found in patients where the presence of tubercle bacilli in the sputum, or the clinical signs and symptoms render the test unnecessary for diagnosis.
6. Non-specific fixations may occur, notably where the serum gives a positive Wassermann reaction.
7. The intensity of the reaction seems to bear no relation to the patient's power of resistance or to the degree of severity of the infection.

REFERENCES.—[1] Widal and le Sourd, cited by Shennan and Miller, *Edin. Med. Journ.*, 1913, 10, p. 81. [2] Bordet and Gengou, *Comp. rend. Acad. de Sc.*, 1903, 137, p. 351. [3] Dudgeon, *Journ. Hyg.*, 1914, 14, p. 52. [4] Besredka and Manhoukine, *Compt. rend. de la Soc. de Biol.*, 1914, 76, p. 180. [5] Besredka, *Ann. de l'Inst. Pasteur*, 1921, 35, p. 291. [6] Miller, *Journ. Lab. and Clin. Med.*, 1916, 1, p. 816; cited by Moon, *Journ. Amer. Med. Assoc.*, 1918, 71, p. 1127. [7] Dudgeon, Meek and Weir, *Lancet*, 1913, 1, p. 19. [8] Dudgeon, Meek and Weir, *Journ. Hyg.*, 1914, 14. [9] M'Intosh, Fildes and Radcliffe, *Lancet*, 22nd Aug. 1914, p. 485. [10] A. L. Punch, *Lancet*, 25th Sept. 1920, p. 647. [11] Miller, *Journ. Amer. Med. Assoc.*, 1916, 67, p. 1519. [12] Moon, *Journ. Amer. Med. Assoc.*, 1918, 71, p. 1127. [13] Burns, Slack, Castleman, and Bailey, *Journ. Amer. Med. Assoc.*, 1917, 68, p. 1385. [14] Corper and Sweany, *Journ. Amer. Med. Assoc.*, 1917, 68, p. 1598. [15] Besredka, *Compt. rend. Acad. de Sc.*, 1913, 156, p. 1633. [16] Inman, *Compt. rend. Soc. de Biol.*, 1914, 76, p. 251; *Lancet*, 1914, 1, p. 1446. [17] Leredde and Rubinstein, *Compt. rend. Soc. de Biol.*, 1914, 76, p. 244. [18] Craig, *Amer. Journ. Med. Sc.*, 1915, 150, p. 781; *Journ. Amer. Med. Assoc.*, 1917, 68, p. 773. [19] M'Caskey, *Amer. Journ. Med. Sc.*, 1917, 154, p. 648. [20] Wilson, *Journ. Immunol.*, 1918, 3, p. 345. [21] Stoll and Neuman, *Journ. Amer. Med. Assoc.*, 1919, 72, p. 1043. [22] Wang and Crocket, *Brit. Med. Journ.*, 1919, 2, p. 7. [23] Calmette and Massol, *Compt. rend. Soc. de Biol.*, 1912, 73, p. 120. [24] Bass, *Compt. rend. de la Soc. de Biol.*, 1920, 83, p. 1261. [25] Fried, *Compt. rend. de la Soc. de Biol.*, 1920, 83, p. 1312. [26] Goldenberg and Fried, *Compt. rend. de la Soc. de Biol.*, 1920, 83, p. 1370. [27] Caulfield, *Journ. Med. Res.*, 1911, 24, p. 101. [28] Woods, Bushnell, Maddux, *Journ. Immunol.*, 1917, 2, p. 301. [29] Moursund, *Journ., Infec. Dis.*, 1920, 26, p. 85. [30] Meek, *Journ. Hyg.*, 1914, 14. [31] Von Wedel, *Journ. Immunol.*, 1920, 5, p. 159. [32] Ichok, Goldenberg, Fried, *Compt. rend. de la Soc. de Biol.*, 1920, 83, p. 1363. [33] Mozer and Fried, *Compt. rend. de la Soc. de Biol.*, 1920, 83, p. 1591. [34] Watkins and Boynton, *Journ. Amer. Med. Assoc.*, 1920, 75, p. 933. [35] Cooke, *Amer. Journ. Dis. of Children*, 1921, 21, p. 78. [36] Urbain and Fried, *Ann. de l'Inst. Pasteur*, 1921, 35, p. 294. [37] Negre and Boquet, *Ann. de l'Inst. Pasteur*, 1921, 35, p. 300.

NEW BOOKS

Industrial Colonies and Village Settlements for the Consumptive. By Sir German Woodhead, K.B.E., V.D., M.A., M.D., LL.D., and P. C. Varrier-Jones, M.A., M.R.C.S., L.R.C.P. (Lond.). Cambridge University Press.

This volume reproduces a number of articles contributed by the authors at various dates to the *Lancet*, to the *Journal of State Medicine*, and to the National Association for the Prevention of Tuberculosis. It expounds with considerable insistence the Cambridgeshire scheme, and criticises incidentally—not always we think with sufficient knowledge—various elements in the scheme which is generally in operation throughout Great Britain for the systematised treatment and care of tuberculous persons of the working class.

While the volume is brightened by literary allusion, the statement of the main thesis tends to be patchy, and the information regarding systems other than that of Cambridgeshire is sometimes misleading. Thus, in relation to the history of the Colony, we read that "it was with almost the sole idea of prolonging sanatorium treatment on more economical lines that the Colony was started. . . . While in certain selected cases an endeavour was made to induce such patients to follow a similar occupation when they left the Colony, in very few cases did such endeavours meet with success. . . . The Colony was the expression of opinion that prolonged treatment meant the ultimate arrest of the disease. The whole mind of the medical profession was fixed on the idea of a 'cure,' and disregarded altogether the question of the prevention of infection." Such statements are a travesty of the aims and methods of the Colony as first created twelve years ago as an integral part of the Edinburgh scheme for the treatment and prevention of tuberculosis.

The inherent weakness of the Cambridgeshire scheme and of all similar proposals is revealed in the suggestion that cases of tuberculosis should be drafted directly from the Tuberculosis Dispensary as "Clearing-house" to the Colony. "The Dispensary will be," say the authors, "the means of providing a link between an environment which is unsuited to a consumptive's condition, and the Colony environment which is specially arranged for his convenience and happiness. . . . The Colony, Hospital, and Settlement constitute a complete scheme designed to deal with tuberculous cases of all kinds. Here (in Cambridgeshire) is *no* picking or choosing of the type of case to be treated." In other words, the Colony is conceived by the writers as a dumping-ground for cases of tuberculosis at all stages. This seems to us a jumbling of the

conception of the Sanatorium, Hospital, Working Camp, Colony, and Village Settlement in a way which leads nowise to success, either in treatment or prevention, as experience in America has shown.

We fear that just as the Sanatorium as a place of cure has sometimes been discredited unfairly by reason of the fact that the immense possibilities of the Sanatorium have been clogged or over-weighted by the mass of unsuitable cases obtaining admission, so the Colony, whose purposes and place in the tuberculosis scheme are definite enough, runs serious risk of being discredited by confusion of issues and hasty conclusions on the part of some whose zeal has outrun experience.

The complexity of the problem, occasioned by the universality of tuberculosis and its variability of clinical expression in respect of course and duration, calls for utmost discrimination in the adjustment of the means to the end in view. Tuberculosis schemes—if they are to be worthy of the name—must include well-devised machinery for the detection of the disease at all stages, the recognition of difference of type with varying potential of recovery, and the relegation of cases of differing character and with different outlook to appropriate agencies capable of meeting the respective needs.

While the volume under review contains much that is calculated to arouse interest, we cannot get away from the feeling that the proposals it advocates, based as they seem to be on the popular conception of the uniformity of so-called "consumptives"—a term which recurs repeatedly —without any attempt to signalise essential differences in degree, stage, and outlook, must tend to produce confusion of aim and method rather than betterment.

The Autonomic Nervous System, Part I. By J. N. Langley. Pp. 80. Cambridge: W. Heffer & Sons, Ltd. 1921. Price 5s. net.

Professor Langley has done so much valuable and reliable work in connection with the anatomy and the functions of the autonomic nervous system, that a considered statement such as is contained in this monograph must be received with great respect and with much interest. In this first part he deals with many general questions—nomenclature; origin and distribution of fibres, and their nature. The action of various drugs on different parts of the autonomic system is discussed in some detail. The difficult question of the innervation of capillaries is carefully and guardedly treated, as well as that of the influence of sympathetic fibres on the tonus of striped muscle. His notes on the production of sweat are particularly interesting.

This monograph is of high value, but it is suited to the needs of the physiologist rather than to those of the physician. One feels, on reading these erudite pages, how scanty are the references to clinical facts, and how comparatively little use is made of the reactions of the autonomic

system in its lightest development, namely, in man. There is, in the present day, too great a tendency to separate the simpler physiology of the lower animals from the more difficult and complex physiology of the human being revealed in the results of careful clinical observation.

The construction of the English in this volume, perhaps here and there a little careless, gives one the feeling that Professor Langley has been much pressed for time in its preparation. But this no doubt will be adjusted in a second edition.

This monograph contains such important matter that it should be in the hands of every physiologist, and its pages should be studied with exceptional care.

The Clinical Study of the Early Symptoms and Treatment of Circulatory Disease in General Practice. By R. M. Wilson, M.B., with a foreword by Sir James Mackenzie. Pp. xvi + 245, with 107 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price 15s. net.

Sir James Mackenzie has here emphasised that disease only manifests itself by symptoms, and that although this branch of medicine has been studied throughout the ages, very little is yet understood of the mechanism of their production, and still less of their prognostic significance. This field of investigation is a promising one, and much valuable information will be gathered from it. Dr Wilson has followed the lines laid down by Mackenzie and has made a large number of careful observations, which he records and analyses in this book. No pretence to deal exhaustively with the subjects is made, but the book is a fascinating and instructive essay on the mechanism and significance of some of the more common clinical symptoms. Amongst those discussed are exhaustion, breathlessness, cyanosis, cardiac pain and embarrassment, headache, tremor, extra systole, the pulse rate, relationship of pulse rate and temperature, blood pressure, types of infection, etc.

Dr Wilson is to be congratulated on his excellent work, and his book is to be recommended to those who are tired of rule of thumb methods and seek a fuller knowledge of their profession.

Modern Methods in the Diagnosis and Treatment of Renal Disease. By Hugh Maclean, M.D., D.Sc. Pp. viii + 102. London: Cassell & Company, Ltd. 1921. Price 8s. 6d.

Our thanks are due to Dr Maclean for this concise and useful study of a subject which at present is attracting many workers. He is already well known as one who has made many contributions to our knowledge of disturbances of renal function, and his observations based on an unusually large number of cases command respect. He

subdivides chronic nephritis into two groups—azotæmic and hydræmic —corresponding with what have been generally known as chronic interstitial and chronic parenchymatous nephritis. With our progressive knowledge of kidney function there is no doubt that a classification based on functional rather than on anatomical changes should be adopted, and it is certain that the future will see an extension of this principle. The tests to which Dr Maclean attaches most value are the urea concentration test, the estimation of blood urea, and the diastatic test; he gives full directions as to how they should be carried out. His remarks as to the diagnosis of the lesion in the very common "Cardio-renal" cases are well worthy of study, and what he has to say as to treatment seems to us to be sound commonsense. The only criticism which suggests itself is that there appears to be some ambiguity in his remarks on uræmia. Thus (p. 27) "in true uræmia it [blood urea] is always raised." On page 42 under the heading "Uræmia not due to Urea" we read of uræmia supervening though the blood urea had been reduced to 30 mg. per 100 c.c., and later (p. 68) good urea concentration is said to rule out uræmia. Dr Maclean is so clear and definite in his writing generally, that we venture to point out this apparent lack of precision in view of the great probability of further editions of this useful book being called for.

A Text-book of Gynæcology. By JAMES YOUNG, D.S.O., M.D., F.R.C.S.(Edin.). Pp. 334, with 183 illustrations. London: A. & C. Black, Ltd. 1921. Price 15s.

There are many text-books on Gynæcology written for the practitioner and advanced student, but there has always been a need for a text-, as opposed to a "cram"-book for the student. This necessity Dr Young's book supplies in the fullest measure. It includes all that a student should know, and yet is not too large for him to read during his final year when he has so many subjects to study. We congratulate Dr Young on not having produced a book packed "with authorities, built on authorities, with quotations quoted from quotations," but one which reflects so much of his own personal endeavour. The arrangement of the book is more or less on the usual lines, dealing with the subject in clearly defined sections, but we do not remember any book on the subject which gives the pathology of the various conditions so clearly and succinctly as this does.

The descriptions of operations might with advantage be expanded a little without making the volume too cumbersome; the descriptions are perhaps too condensed for the average student to follow quite clearly.

In the chapter on displacements one hardly expects to find retroflexion of the gravid uterus occupying so much space, as it is fully dealt with in most text-books of Obstetrics, and it seems unnecessary to give an illustration of such a prehistoric appliance as the cup and stem pessary as a method of treatment in prolapse.

The illustrations are numerous and adequate, especially good being the microscopic drawings of Mr Richard Muir. Again we congratulate Dr Young on giving a book to students which is not the result of scissors and paste, and strongly recommend it as of the proper dimensions, and as a fitting companion to the *Text-book of Obstetrics* in the Edinburgh Medical Series, to which it belongs.

The Surgical Treatment of Non-Malignant Affections of the Stomach. By Charles Greene Cumston, M.D., and Georges Patry, M.D., London: Wm. Heinemann, Ltd. 1921. Price 15s. net.

Had the words "A Review of" been placed in front of the above title the scope of the book would have been well indicated. The authors have collaborated in an effort "to group and study the data acquired during the past twenty years in the domain of gastric surgery," and have produced an interesting and extended critical review dealing with operative procedures, gastric ulcer in its various aspects and the other non-malignant conditions of the stomach which may call for surgical intervention. They trace and summarise well the gradual development of our knowledge of gastric ulcer, and discuss, in the light of their own clinical experience as surgeons, the merits of the various surgical measures that have been and are employed in gastric surgery. We note with interest their lingering affection for Murphy's button, and with surprise and emphatic disagreement their recommendation that in perforated gastric ulcer operation should be deferred until the phase of shock has been overcome. While their point of view has been that of the surgeon, their aim has been to treat specially questions of interest to both physician and surgeon. In this they have succeeded and have given a survey of their subject which should prove of value to all concerned in the treatment of gastric disorders.

FOREIGN BOOKS

Le Sucre du Sang. By R. Lépine. Pp. 168. Paris: Librairie Felix Alcan. 1921. Price 25 francs.

In this volume are published the results of twenty years of laborious experimental work on the sugar of the blood by the late Professor Lépine of Lyons, who died in 1919. The question of

blood sugar is dealt with almost entirely from the standpoint of the experimental physiologist, without any explicit reference to clinical medicine. It will, however, be found of great interest to all workers on this branch of physiology.

Le Diabète Sucré. By Dr Marcel Labbe. Pp. 376. Paris: Masson et Cie. 1921. Price 20 francs net.

This is an extremely detailed clinical study of diabetes, of which the author recognises two main types—diabetes without malnutrition and diabetes with malnutrition. Other forms of glycosuria, such as that associated with acromegaly, and bronzed diabetes are also fully described. The chapter on treatment will not, it is to be feared, appeal very strongly to British readers; the modern methods associated with the names of Allen and Joslin, which most of us here regard as a very real advance, are only cursorily mentioned. For some reason these do not appear to have received the attention they deserve in France, and Dr Labbe does not write as if he were familiar with their details. Apart from this defect, the volume is a useful study of diabetes.

NEW EDITIONS

The Diagnosis and Treatment of Venereal Diseases in General Practice. By Lieut.-Col. L. W. Harrison, D.S.O., K.H.P. Third Edition. Pp. xx. + 525, with 102 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price, 25s.

The author states that his object in writing this book is to assist the general practitioner in reducing to negligible proportions the evils due to venereal diseases. He is desirous, too, to excite in the members of the medical profession a keener interest in the problems which they present. With the first object in view he naturally concentrates his efforts on a thorough exposition of the technique of early diagnosis and of treatment, and in this respect he is eminently successful. His endeavour to excite in the general practitioner a keener interest in syphilis would have been more successful had he devoted more space to our recent conceptions of the pathology of this disease in its latent and late stages. No hint is given of the interesting field for enquiry available to those who make use of the Wassermann test, and by careful clinical observation, especially as regards the results of treatment, may be able to detect many unsuspected symptoms of syphilis. Congenital syphilis, a subject of importance and interest in general practice, receives comparatively little attention. The value of applying the Wassermann

test to every member of a recognised syphilitic family is not mentioned, and our new ideas concerning "the law of Colles" are not discussed at all. The incorporation of a chapter on the Medico-legal Aspects of Venereal Disease enhances the value of the book considerably.

Diseases of the Digestive Organs, with Special Reference to their Diagnosis and Treatment. By CHARLES G. AARON, Sc.D., M.D., F.A.C.P. Third Edition. Pp. 904, with 225 illustrations. London: H. K. Lewis & Co., Ltd. 1921. Price £2, 10s. net.

This manual may be considered in two sections. In the initial third, after a brief *résumé* of the physiology of digestion, the author deals exhaustively in turn with the examination of the stomach contents, examination of the duodenal contents, and examination of the fæces; then gives a good brief *résumé* of the X-ray examination of the digestive tract; an account of the various special diets applicable to gastro-intestinal disorders; forms of manipulative treatment, such as lavage, massage, and internal electrical applications; and the special medication of this system. This earlier portion of the book is specially useful, and it gives a good account of all the newer tests and methods of examination. The latter two-thirds of the work deals with the individual diseases systematically from mouth to anus, and include short chapters dealing with the liver and pancreas. The volume is of special value to the physician who takes a particular interest in this branch of internal medicine, but is also an excellent book of reference for the general practitioner or the surgeon.

Mind and its Disorders. By W. H. B. STODDART, M.D., F.R.C.P. Fourth Edition. Pp. xvi. + 592, with 84 illustrations. London: H. K. Lewis & Co., Ltd. 1921. Price 22s. 6d.

In the earlier editions of this work the author presented his subject from the neurological point of view, but as an adherent of the Freudian school he now treats mental disease from the psychological side, while not altogether abandoning other methods of research into mental processes. We think that, like so many Freudians, he exaggerates the rôle of sex in the causation of disease.

The first part of the book deals with normal psychology, a very necessary introduction to the proper understanding of abnormal psychology. Part II.—Psychology of the Insane—treats of disorders of sensation, perception, emotions, judgment, etc., and includes a chapter on psycho-analysis. The remainder of the book is devoted to mental diseases, which are described in a lucid fashion. As a result of the new psychology and researches in endocrinology and other directions, a re-classification of disease has been made. This is a distinct advance,

but the inclusion of exophthalmic goitre amongst the neuroses will not meet with general approval. The concluding chapters deal with diseases to which the insane are specially liable, general treatment, the insane and the law, etc. Some details of laboratory methods of diagnosis are given in appendices. The book can be thoroughly recommended to the attention of the medical profession.

A Treatise on Diseases of the Skin. By H. W. Stelwagon, M.B., Ph.D., and H. K. Gaskill, M.D. Ninth Edition. Pp. 1313, with 430 illustrations. Philadelphia and London: W. B. Saunders Company. 1921. Price 50s. net.

This edition contains new material and many fresh illustrations. The illustrations throughout the book are good, and form a valuable part of the work. The more recent advances in dermatology are mentioned. The diagnosis of the different diseases is fully discussed and should prove very helpful. Treatment, also, is detailed, while there are numerous references for any who wish to pursue a particular subject. One would expect that lichen scrofulosus and erythema induratum would be included in the section on tuberculosis instead of among the erythemata.

Practical Physiological Chemistry. By J. A. Milroy, M.A., M.D., and T. H. Milroy, M.D., B.Sc., F.R.S.E. Third Edition. Pp. ix. + 449, with 12 illustrations. Edinburgh: W. Green & Son, Ltd. 1921. Price 21s.

This well-known text-book has somewhat altered its character in the present edition. Originally intended for the use of junior students attending instruction on practical physiological chemistry, the book has now been enlarged so as to meet the requirements of more senior students as well. The first half of the volume deals with qualitative methods of examination, and gives clear and concise directions for practical work. (These are printed in italics.) Copious explanatory and theoretical notes are introduced (in Roman type) to assist the student to understand the processes employed. Section II. is devoted to quantitative analysis. This branch of the subject has expanded enormously during the past few years, and a large number of new methods have become available. The authors are to be congratulated on their selection of the most valuable of these. Many useful tables are included in a large appendix, and the book is completed by the addition of a series of schemes for detection of unknown substances. We can heartily recommend this book to those for whom it is intended.

NOTES ON BOOKS

Studies in Influenza and its Pulmonary Complications, by D. Barty King (J. & A. Churchill) is a most scientific clinical record of hospital cases occurring in the recent pandemic. The first chapter deals with 150 malarial cases, and reveals many interesting points which arise when the malarial subject takes influenza. The second chapter, which discusses the after-effects of acute pulmonary complications of influenza, points out the great value of radioscopic, in combination with clinical examinations, particularly as a guide to immediate beneficial after-treatment. The third chapter gives a most instructive record of the epidemic as it affected the nursing staff of the same hospital. The records are essentially clinical rather than bacteriological, and to those who had similar wide experience of the pandemic the conclusions will not appear striking.

The second edition of Lyle's *Manual of Physiology* now appears under the joint authorship of H. Willoughby Lyle and David de Souza (Henry Frowde and Hodder & Stoughton, price 21s. net). The text has been revised, and minor additions have been made with the object of bringing the work up to date. The manual is intended to be a concise exposition of the main facts of physiology, and, as the authors admit, is in no way supposed to supply the place of a practical text-book. Wherever possible, indication is made of the bearing of physiology upon practical medicine and surgery, and, for this reason, the volume will be of special value to medical students and practitioners.

The Physiology of Gout, Rheumatism, and Arthritis as a guide to accurate diagnosis and efficient treatment, by Percy Wilde, M.D. (John Wright & Sons, Ltd., price 12s. 6d. net) is written by one who has had over thirty years' concentrated experience of these subjects. The contention that lactic acid plays so great a part in what the author calls the physiology of these conditions has been held by him all along: the skin being the natural eliminator, and the cure depending largely upon the intermittent raising of body temperature until the skin is no longer excessively acid. Bio-chemists should give us scientific confirmation of them if they can, and so extend the information on the subject in the current text-books on Physiology, thus giving us confidence in treating such cases from the author's point of view.

Dr Aleck W. Bourne's *Synopsis of Midwifery* (John Wright & Sons, price 15s. net) has a distinct field of usefulness both to teacher and student. The present (second) edition has been brought up to date, mainly as regards the toxæmias and hæmorrhages. The section on the management of labour with contracted pelvis is sound and practical.

Notes on Books

The object of *Domiciliary Treatment of Tuberculosis*, by F. Rufenacht Walters (Baillière, Tindall & Cox, price 12s. 6d.) is to give, in reasonable space, guidance to the general physician in treating his tuberculous patients at home. Tuberculin in treatment receives careful consideration, and the author has much faith in its use as an aid to recovery in suitable cases.

Orthopædic Apparatus, by F. G. Ernst (The Whitefriars Press, Ltd., price 12s. 6d.). Mr Ernst shows in this book that he possesses the mechanical gift as well as the technical knowledge of materials which are necessary for the production of first-class appliances. His article on trusses and abdominal belts indicates a careful study of these often difficult cases. Every surgeon who wishes to know what external mechanism can do to relieve deficiencies in the normal bodily mechanisms will find in this book a useful guide.

A Guide to Urinary Diseases, by Adolphe Abrahams, M.D., and A. Clifford Morson, F.R.C.S. (Edward Arnold & Co., price 9s.) is written by a physician and a surgeon for the general practitioner to guide him as to symptomatology and treatment, as to what tests and investigations he can carry out by himself, and as to how far he can go without seeking for expert assistance from a specialist in urinary cases. Such help this book can give him.

In the second edition of his *Text-Book for Midwives*, Dr John S. Fairbairn (Henry Frowde and Hodder & Stoughton, price 25s. net) has almost entirely re-written three of the chapters dealing with the Infant. The development of the physiological processes of the new-born infant; its hygiene and protection from infection; its management and feeding, are matters of ever-increasing importance in these days, since both midwives and health visitors are workers in the health service of the community, using their combined knowledge to lessen the high rate of infant mortality. The book will also prove most helpful to teachers of midwives, from its originality and lucid methods of expression.

Hygiene of Women and Children, by Dr Janet E. Lane-Claypon (Henry Frowde and Hodder & Stoughton, price 15s.), is written with the professed object of encouraging the promotion among women of a higher standard of individual health than commonly obtains at present. The reasons for the hygienic requirements of modern-house construction as well as for the maintenance of good sanitation in existing habitations, may be easily grasped by the reader knowing some of the elements of physical science, as well as that personal health is dependent also on a wise choice of clothing, food, and proper supply of recreation, sleep, and exercise. By means of statistics, the writer shows the urgent need for the provision of a healthy milk-supply for infant-feeding, and

describes the experimental work relative to the investigations of the food deficiency obvious in infants and older children. The book is recommended to health visitors, nurses, and others interested in mother and child welfare.

Diseases of the Eye, by George E. de Schweinitz (W. B. Saunders Co., Ltd.), price 50s. net. In the ninth edition oft his well-known text-book about thirty subjects are dealt with for the first time. A number of new illustrations have been added, and the index is extremely full. Although somewhat condensed, it is one of the completest text-books of Ophthalmology in the English language.

Cataract and its Treatment, by Henry Kirkpatrick, M.B. (Henry Frowde and Hodder & Stoughton, price 12s. 6d. net) is based upon Colonel Kirkpatrick's wide experience in India, but it also embodies in a condensed form an account of most of the important work that has been carried out on the subject of cataract during recent years.

BOOKS RECEIVED

BERKELEY, COMYNS, etc. Edited by. Diseases of Women. Second Edition . . . . . (*Edward Arnold & Co.*) 30s.

BEZANÇON, F. Les Bases Actuelles du Problème de la Tuberculose (*Gauthier-Villars et Cie, Paris*) Frs. 7

BIANCHI, LEONARDI: Translated by James H. Macdonald. The Mechanism of the Brain and the Function of the Frontal Lobes (*E. & S. Livingstone*) 21s.

BRILL, A. A. Psychoanalysis: Its Theories and Practical Application. Third Edition . . . . . (*W. B. Saunders Co., Ltd.*) 24s.

DEANE, EDMUNDE. (Reprinted by James Rutherford). Spadacrene Anglica, or the English Spa Fountain (*John Wright & Sons, Ltd.*) 6s.

DEPARTMENT OF HEALTH OF THE STATE OF NEW JERSEY: Forty-fourth Annual Report . . . . . (*Published by the State*)

EWING, JAMES. Neoplastic Diseases: A Treatise on Tumours. Second Edition . . . . . (*W. B. Saunders Co., Ltd.*) 55s.

FOTHERGILL, W. E. Manual of Midwifery. Fifth Edition (*W. Green & Son, Ltd.*) 10s.

HARE, HOBART AMORY. A Text-book of Practical Therapeutics. Eighteenth Edition . . . . . (*Henry Kimpton*) 36s.

HAYES, REGINALD. The Intensive Treatment of Syphilis and Locomotor Ataxia by Aachen Methods. Fourth Edition (*Baillière, Tindall & Cox*) 4s.

HULBERT, H. H. Eurhythm: Thought in Action (*Novello and Co., Ltd.*) 9s.

MEDICAL ANNUAL, 1922 . . . . (*John Wright & Sons, Ltd.*) 20s.

SOMERVILLE, H. Practical Psycho-Analysis (*Baillière, Tindall & Cox*) 6s.

STILES, Sir HAROLD, and M. F. FORRESTER-BROWN. Treatment of Injuries of the Peripheral Spinal Nerves (*Oxford Medical Publications*) 15s.

THOMPSON, C J. S. A Compendium of the Pharmacopœias and Formularies. Sixth Edition . . (*John Bale & Sons, Danielsson, Ltd.*) 10s.

VINCENT, SWALE. Internal Secretion and the Ductless Glands. Second Edition . . . . . (*Edward Arnold & Co.*) 25s.

WOLBACH, S. BURT, JOHN L. TODD, and FRANCIS W. PALFREY. The Etiology and Pathology of Typhus . (*Harvard University Press*)

Edinburgh Medical Journal

June 1922

FURTHER INVESTIGATIONS INTO THE ETIOLOGY OF MALIGNANT DISEASE AND LEUKÆMIA: INCLUDING AN ACCOUNT OF LYMPHOMA AND LYMPHO-SARCOMA EXPERIMENTALLY PRODUCED IN THE MOUSE.*

By JAMES YOUNG, M.D., F.R.C.S. (working under the National Research Council).

In June 1921 I communicated to the Edinburgh Obstetrical Society[1] a record of investigations in which I had succeeded by special methods of cultivation in isolating a germ with specific characters from a considerable number of carcinomatous growths of human origin. Altogether this germ has been obtained in thirty-four out of forty such tumours examined, and an organism with similar general cultural features has been isolated from four carcinomatous growths in the mouse. The organism was obtained by incubating the tumour tissue under partial anaërobic conditions in a fluid medium rendered acid by the fresh addition of a solution of ·2 per cent. HCl placed in the medium so as to surround the tumour fragment.

In the communication referred to it was shown that the organism possessed a specific life cycle, and from an extended histological study of the tumour fragment after varying periods of incubation, the suggestion was made that the parasitic form of the organism consisted of a minute phase which was passed in the nucleus of the cancer cell. The presence of the organism, which lived in the cell, and which was conveyed to the daughter cells of a division, it was suggested, might account for the continued stimulus to growth and the riotous proliferation that characterised the malignant process.

In January 1922 I communicated to the Pathological Society of Great Britain and Ireland[2] a preliminary communication

* Received for publication, 25th March 1922.

on the results of the experimental inoculation of the mouse organism into mice. The present paper incorporates a further account of these experiments and, in addition, contains a description of some new investigations.

Human Organism (Figs. 1, 3, 4, 10, 11).—This is pleomorphic, and during its growth exhibits forms which differ from one another very greatly in size and appearance. The minute phase grows as minute granules, and slender bacillary and filamentous forms. The latter may grow to a considerable length, stretching on occasion right across the microscopic field. The minute forms in culture quickly develop into a larger phase, which usually appears as thicker rods, staining more deeply at their ends, and as darkly staining cocci or flattened diplococci. When the initial culture is copious, this phase may occasionally be transferred successfully to an ordinary agar or serum-agar slope, when it grows under free aërobic conditions as isolated round pale white colonies or as a continuous pale watery smear.

In the large coccoid phase the organism tends to clump into round or lobulated masses of greatly differing size. These masses stain deeply with ordinary stains, and the outlines of the individual bodies may only be made out with difficulty. In this condition the aërobic growth often presents a yellowish colour.

For free isolation from the tumour incubation at body temperature is necessary. In its later phases the organism may, however, be found growing steadily at room temperature.

It is not difficult to obtain by plating a pure growth of the large coccoid form, and subculture of this in an acid fluid medium (and for this the absence of air is not essential) is followed by the appearance of the minute phases which have been described. These are found to originate from the large round bodies which pass through a process of germination. They become paler and enlarge, swelling up often to several times their original size. In this phase they resemble a yeast. The original clumps may remain, with the individual bodies fused together, in which case large masses of germinating material are found in the medium, masses as large, it may be, as 40 μ or more in diameter. Where the individual bodies are separate they may reach a size of 3 to 4 μ or more in diameter.

On occasions, when growing in a fluid medium, the coccoid forms develop in chains, which may be of considerable length. On such a chain one or more of the elements may be found

enlarging into the reproductive form, and under these conditions the appearances resemble the formation of chlamydospores as this occurs on the fragmented mycelium of some fungi.

During germination striking colour changes may be seen. To begin with, as stained by Leishman, the reproductive masses and cocci and yeast-like bodies have a uniform purple colour. This shades off rapidly, and as the process proceeds the germinating masses become blue or greenish blue, with, scattered about their substance, granules that are often highly refractile and that stain a deep purple. The mass may be richly studded with these granules. The appearances presented vary somewhat in different cases, depending on the medium, temperature, acidity, etc.

The isolated reproductive elements are usually round or ovoid in an ordinary culture, and during certain stages of their mutation, in their general shape and size and staining characters, they often present a striking resemblance to cell-nuclei.

The interpretation of the appearances and the tracing of the sequence of events are not easy. For example, occasionally a small round or oval body with pale blue protoplasm and a point or bar of purple matter, which is usually eccentric or peripheral in position, is seen at this stage. An intensive study of the life cycle suggests that this body is formed by a subdivision of the swollen germinating forms, though the rapidity of the process or the nature of the medium may disguise its appearance.

The next stage consists in the liberation of the organism in the minute form (granular, bacillary, or filamentous).

The germination process is rapid, and can occur in a comparatively few hours (twelve to twenty-four hours). The stages cannot usually all be deciphered in one culture; the description given above is, as a matter of fact, the result of more than a year's elaborate study with a correlation of many isolated observations. In many cases, for example, the coccoid body swells up and bursts, and there is nothing to represent this stage of the process except the fragmented remains of the capsule with the amorphous granular matter which has escaped from it. Sometimes, also, the bacillary and filamentous forms fail to develop, and the minute granules which are liberated pass by gradations as they enlarge into small cocci and later into the larger coccoid bodies. In the culture from which the majority of the above observations are derived, germination regularly for some months gave the usual picture.

Eventually, however, it failed to produce the rod-like bodies; the larger bodies, instead, giving rise to small cocci or diplococci.

On two occasions in old cultures where the media had become inspissated by evaporation, I have found all the phases—minute and large—represented almost entirely by unbranched filaments, the finer ones staining faint blue and the thicker ones deep purple with Leishman. On subculture on the ordinary media this aberrant type quickly reverts to the usual forms, thus proving its identity. When it occurs in such thick filaments, germination follows the same general procedure as we have described for the massed coccal form, except that in this instance the swelling and the colour changes and the granule formation all occur in, as it were, a linear or filamentous manner. The pale blue bodies with the eccentric granules then lie end to end. Before finally breaking up to liberate the minute granules, the pale thick rod can often be found to have a central, thin, tortuous or spiral core. This appearance can occasionally be seen during the early germination stages of an ordinary culture.

As we have seen, germination of the coccal form can easily be induced by placing it in a special cultural environment. On the other hand, the same process may occur spontaneously on a slope medium.

Mouse Organism (Figs. 5, 7, 8, 9).—In its general cultural features this resembles the human organism. It differs from it, however, in the ease with which it can be isolated from the infected tissues of the mouse, smearing the tissue over the surface of an ordinary aërobic agar slope being often sufficient. Again, the coccoid form, in the strains which I have under investigation, shows little tendency to a fusion into clumps on an aërobic slope. It grows as a white or cream-coloured surface closely resembling an ordinary staphylococcus albus. On subculture of the coccoid form in a fluid acid medium, I have never found the large blue nucleus-like forms that are commonly found during the germination of the human reproductive stage. The purple yeast-like forms are found instead. On several occasions, however, I have found the blue forms in the tissues of animals artificially infected. For example, I have found them in the subcutaneous tissue of animals in the neighbourhood of a scratch made several days previously, and into which a suspension of the bacillary phase of the organism had been rubbed. The yeast-like and nucleus-like phases are

then often found in profusion. I have also seen them in the smear made from the liver of an animal, in which an intra-peritoneal injection had been given several days previously. In the organs of such animals, fixed and cut in paraffin, whilst the bacillary forms are easily recognised, the large forms cannot usually be distinguished easily from cell nuclei and cellular detritus.

In a preceding communication I have shown that bodies like this are usually recognisable in a mouse cancer and, on incubation of the tumour tissue, they may be seen to give origin to the minute coccal and the bacillary forms (Fig. 5). I believe it likely that the yeast-like bodies that several observers have described in cancerous tissue are in reality the larger phase of the organism which I am describing.

The small pale blue bodies with the eccentric or polar acidophil granules or bar can often be found in mouse cultures and I have, I believe, been able to recognise them giving rise directly to minute granular or bacillary forms.

Just as was the case for the human organism, the mouse organism does not require a special acid environment for germination. We have seen that it may take place in the circulating blood. I have witnessed it also occurring on an agar slope kept at room temperature.

Sexual Forms? — The apparent multiplicity of forms appearing during the growth both of the human and mouse organisms may possibly with further study be found to resolve into a simpler picture in which male and female elements are recognisable. For a considerable time I have felt that such must be the case, but despite careful and tedious observation I have so far been unable to formulate clearly any definite sex sequence.

We have seen that the pale blue body with an eccentric granule seems to liberate minute round or rod-like forms, and it may be that these denote gametes (male), while the large blue, nucleus-like forms which often possess a central darkly staining granule in their centre, may represent the other class of gametes (female). When ripe these may be seen to liberate comparatively thick rods; in this stage they may correspond to the mature zygote or sporcyst of other parasites. The interpretation of the process is, however, difficult, and further study is necessary before anything like a definite opinion can be ventured.

Staining.—Both the human and the mouse organisms stain well with the ordinary dyes. For routine purposes Leishman's stain has been largely employed. The larger forms are gram-positive. The minute phases may be gram-negative or irregularly gram-positive. The organism is not acid-fast.

Experimental Injection of Mouse Organism.

Type of Animal employed.—One hundred and seventy-nine mice of all colours and ages, but chiefly animals over six months, have been employed. Guinea-pigs and rabbits have also been used. With the latter animals the results have been negative, but the experiments with them have been too limited and of too short a duration to justify any deductions.

Method of Exhibition.—In each case a single injection was made. The material used was derived usually from an aërobic slope culture and was made up in a suspension in normal saline solution. In all but a few animals the injection was intra-peritoneal; in the others (8) it was into the right mammary region.

An intensive study of the life cycle of the organism suggested that, if it bore any etiological relationship to malignant disease, the minute forms in the cycle probably represented the infective stage. For all the experiments cultures containing this phase were employed.

Study of the Pathogenic Effects.—As all the experiments are still in progress, a complete record of results cannot be given. This will be apparent when it is stated that nearly every day a positive case is being obtained, sometimes in animals recently injected, but also in animals injected as long back as three to seven months.

Up to date 96 animals which have died fall to be reviewed. In 5 no pathogenic lesions were found.

The lesions exhibited by the remaining 91 are of two kinds, (*a*) toxic, and (*b*) proliferative in nature.

The toxic action may kill within a few hours, whereas the proliferative or neoplastic effects may be followed by a fatal issue only after many months (maximum length in series seven months).

In general terms the two actions have well-marked lines of distinction. At the one end we witness an action which in its fulminant nature may have all the characters of an acute poison, whilst at the other end we are brought face to face

with an action which in its insidiousness and gradually progressive character has none of the features of a toxæmia as ordinarily understood. Whilst there are these fairly prominent distinctive features at the two extremes, in many intermediate instances the two processes may co-operate or overlap in the same animal. So, even in an animal which lives long enough to present the features of a chronic process, combined with the cellular proliferation, there may be manifestations of cellular destruction.

Acute or Toxic Effects.—The strain of organism, which was used for the earlier experiments and which possessed little or no immediate lethal effects on injection into mice, when employed fresh after its recovery from the organs of an infected mouse was found to possess increased virulence in terms of toxicity. For the earlier experiments the strain used was isolated from a transplanted breast carcinoma in June 1921, and it was maintained on the ordinary laboratory media. At the moment it is being employed in a sixth generation subculture. In the experiments death by injection of this medium-transmitted strain has occurred after periods varying from eight days to seven months. Whether the increased virulence of the recovered organism is due to passage, or whether it is merely due to its being used soon after recovery, as compared with the laboratory strain, which is being used after repeated subculture, is a point still requiring investigation.

The toxic action is demonstrated in the following experiments :—

(*a*) A 48-hours' culture obtained from the liver of mouse 22, which lived for eight days after the injection of a sixth generation strain, was injected intraperitoneally into 12 mice. All died within twenty-four hours, and the organism was obtained in pure culture from the heart blood of two of these mice selected at random.

The virulence of this transmitted strain diminished by keeping at room temperature. After twenty days 10 mice were injected, and these lived for periods varying from four to eight days.

(*b*) Eighteen mice were injected with culture obtained from spleen of mouse 23, which lived for nine days after receiving a sixth generation subculture of the ordinary strain. The 18 mice died after periods varying from fourteen hours to six days.

The lesions found in these acute cases consist of toxic

degeneration of the liver and kidney cells, with, in the former, scattered necrosis. There is usually also a patchy broncho-pneumonia. The organism can be obtained in culture from the heart blood. Those animals that live beyond a few days present an extensive lymphoid reaction which will be described under the next heading.

It is difficult to give the exact number of animals that died with evidence of toxic changes. All those that died within seven days (38) fall into this class, but a considerable number of the remaining animals present lesions in the internal organs, *e.g.*, liver, that bring them also within this group.

Proliferative Effects—Epithelial Tumours.—The experiments had as their object the testing of the possible causal relationship of the organism to carcinoma. From the standpoint of producing carcinoma in a satisfactory number of mice the experiments have been unsuccessful. Altogether tumours with the histological characters of carcinoma have been found only in 2 mice (mouse 6, after three months, and mouse 59, after six months). In mouse 6 it was a rapidly growing adeno-carcinoma, probably of mammary origin, which developed near the site of injection. It reached a large size and killed the animal from hæmorrhage. In mouse 59 the tumour was a comparatively small adeno-carcinoma of the breast (Fig. 15). In a third mouse (mouse 54, five weeks) a small growth with the structure of a benign adenoma of the breast occurred. In none of these cases were secondary growths found in the glands or other organs.

In mouse 6 no other lesions were found. In mouse 59 and mouse 54 lymphoid lesions were present, which bring these animals into the category of the bulk of the animals. These fall to be described in the next paragraph.

In no case has carcinoma been obtained in control mice. The interpretation of the small carcinoma finding will be reserved for a later paragraph, when it can be discussed more profitably after all the results have been presented.

Lymphoma and Lympho-sarcoma.—Under this heading fall 74 mice which survived for periods as follows: Two to four days, 17; four to seven days, 16; seven to fourteen days, 8; fourteen to twenty-eight days, 12; twenty-eight days to two months, 8; two to three months, 7; three to four months, 3; five to six months, 2; seven months, 1.

In these 74 mice, which include 1 with carcinoma, a some-

what remarkable neoplastic process of a diffuse character, involving cells of the blood and lymph systems, has been obtained. In its general features this process is capable of fairly easy study, but there are many points of detail which are still in doubt.

The tissue especially, and, it would seem in some cases solely affected, is the lymphoid tissue and the changes would seem in many cases to be co-extensive with the distribution of the lymphoid elements throughout the body, occurring in lymph glands, lymphoid patches in the intestine, thymus, liver, spleen, etc. In an acute case the reaction may present appearances suggesting an ordinary inflammatory process. But this may be absent from the beginning and, in an ordinary case, in the essential characters, as studied in the internal organs, *e.g.*, the liver and spleen, the picture is that met with in lymphatic leukæmia, the degree of lymphoid proliferation and infiltration being roughly proportional to the time of survival of the animal after the injection (Figs. 26, 27, 28). In a marked case the infiltration and destruction of the normal structure of the organs may be such as to suggest a malignant picture (Figs. 2, 25, 31, 37).

Where purely lymphoid tissues are involved tumours of considerable size may develop, *e.g.*, lymph glands (Fig. 20), lymph follicles in the intestine, and thymus. Here again the extent of the process varies roughly with the period of survival, from a condition which, in an early case, may resemble a benign lymphoma, up to a process which, in an advanced case, may be associated with invasion of gland capsules and an infiltration of surrounding structures by the invading cells. We then witness changes that characterise a true malign tumour process. In these cases the histological picture is that ordinarily described as lympho-sarcoma, the diffuseness of the process bringing it within the category of what is sometimes termed lympho-sarcomatosis.

The literature bearing on growths of lymphoid origin shows that the subject is still in a state of considerable confusion, and this chaos finds its reflection in nomenclature. The obvious and main difficulty in this connection is that whilst, at one end, the phenomena have an apparent infective origin, at the other end they merge into frank malignant neoplasms, and the difficulty is exaggerated by the existence of all gradations between the two extremes.

It is apparent that the bringing of the varying conditions under one common etiology would simplify the subject by showing that they are, as has often been suspected, differing manifestations and stages of the same disease. It would then be seen that the phenomena of a patently infective character fall within the acute manifestations of the disease, whilst the neoplastic fall under the more chronic manifestations of the same disease.

Whilst, as I have said, the invasive characters are usually most evident in a well-established case, in some animals, which have survived for no longer a period than four to nine days, these characters may be already visible.

An intensive study of the lesions has made it abundantly apparent that we are dealing throughout with a single process which is essentially of a neoplastic and progressive character. This is shown by the histology, for in the widely scattered areas of involvement the cellular picture is uniform. In the liver, spleen, lymph glands, thymus, etc., the elements that are stirred into activity are apparently the same in each instance. The areas of overgrowth and invasion consist in all cases of uniform aggregations of cells. All gradations can often be discerned between a large cell with a relatively large share of protoplasm and possessing often an oval nucleus to the typical small lymphocyte with its meagre protoplasm (Fig. 24). The relative proportion of the large and small cells differs somewhat in different sites. Giant cells do not appear in the picture. The tracing of the ultimate origin of the cells is often a matter of histological difficulty, though, as we shall see, in most regions there seems no reason to doubt that they arise *in situ* from pre-existing elements. How far the reticulum shares in the change, if at all, is undecided. The endothelium, I believe, does not take part in the formation of the tumour cells.

An evidence of the activity of the proliferation is seen in the mitotic figures which are practically always found in abundance in a well-fixed section (Figs. 23, 24).

A consideration of the blood and the marrow will be reserved for a later page.

Study of Special Tissues and Organs.

Liver.—In a marked case this is enlarged, sometimes to an excessive degree, and its surface is mottled by white or yellowish areas of varying shape and size. In two cases the enlarged

organ was uniformly pale yellow in colour. In one case (mouse 59, after six months) there was a large hæmatoma in the left lobe. The liver is usually non-adherent, but in a few cases it may be fixed by fine adhesions to the stomach, diaphragm, or abdominal wall.

Microscopically, the histological picture is that of lymphatic leukæmia, the lymphoid growth being especially abundant in the portal areas (Fig. 26), and extending in the form of plugs of tumour cells into the surrounding parenchyma. Even in an early case the hepatic capillaries may be filled with lymphocytes (Fig. 28). In an advanced case the liver tissue may be ploughed up and destroyed by the invading cells (Figs. 2, 23, 25). Sometimes the tumour cells assume a pseudo-acinar arrangement; this is rare.

A close study of the appearances has practically convinced me that the neoplastic cells may, and usually do, originate *in situ* in the liver from the lymphoid nodules which, even in the adult, are constantly present in the normal mouse liver. In an early case in such a small nodule the beginning of the process is frequently shown by one or two mitotic figures (Fig. 23). Once begun the change may progress with remarkable rapidity, and I have on several occasions found it advanced to a considerable degree in animals that have lived only a few days.

In many cases, in addition to invading the parenchyma, the proliferating cells may be found in vessels, the lumina of which may be completely plugged by the tumour cells. Mitotic figures may be present in these intravascular elements.

In a few cases I have noted a tendency to the bulging of liver cells into the vessels, along which solid masses may extend for a considerable distance. The significance of this appearance I have not been able to clear up. Such an appearance is found in hepatoma, but in none of my sections have I ever found mitosis in the parenchyma elements, and it is therefore impossible to accept the appearance as indicating an associated proliferation of true hepatic cells.

In an acute case commonly, and in a chronic case rarely, a patchy necrosis may be found in the liver. In one case a large area of regenerating liver cells was found.

In many cases the vessels of the liver are distended, sometimes forming large thin-walled sinuses.

In many cases a slight amount of periportal cirrhosis is found. In no case is it considerable, whilst it is usually absent.

Spleen.—Enlargement of the spleen of a uniform nature is practically invariable. In an advanced case this enlargement may be excessive. The organ has a uniform dull-red colour.

Microscopically the enlargement is found to be due to a great excess of the lymphoid elements, which replace the normal tissue and disorganise the usual structure. The Malpighian corpuscles are enlarged and, in an advanced case, the lymphoid overgrowth may obscure the Malpighian outlines, which seem to fuse with one another. Large numbers of the neoplastic cells are often found in the splenic vessels.

Lymph Glands.—The changes here consist of enlargement in some cases to the extent of forming tumour masses of considerable size in the axilla, thorax, mesentery, etc. (Figs. 14, 20, 21, 33, 35).

Microscopically the enlargement is found to be due to an overgrowth of the lymphocytes, which overrun and disorganise the healthy arrangements.

In an early stage the architecture of the gland may be still recognisable, but this is never the case when the process is advanced. In many cases the capsules are invaded and eroded and the liberated cells proceed to invade the surrounding tissues of the mesentery, bowel, etc. In many cases the tumour cells, can be seen attacking the vessel walls and working their way through into the vessel lumina.

The animals vary greatly in their tendency to form lymphatic tumours. The most rapid development of the process in the series is found amongst the animals that die with evidence of a fairly acute infection, and, whilst they live long enough to allow of the development of a neoplastic change, they do not survive into the chronic stages.

Eleven animals that survived for periods of six to nine days exhibited a degree of lymphoid overgrowth in the mesentery, mediastinum, liver, etc., which was remarkable. Figs. 21, 33, and 35 show such cases. The mesentery is occupied by solid tumour masses, and it is whitened by solid plugs of lymphoid tissue surrounding the vessels. The appearances have a suggestive resemblance to some cases of so-called "status lymphaticus" in the human subject where, following death from an acute infection, extensive lymphoid overgrowth is found at the post-mortem.

In these animals the infective characters were prominent, and post-mortem examination revealed such conditions as

peritonitis, broncho-pneumonia, and toxic changes in the parenchyma of the liver and kidney. Whether their resemblance to some recorded cases of status lymphaticus in the human subject depends on a deeper identity remains to be seen by further study. In this connection, however, I have received a strikingly suggestive piece of information from Dr Charles M'Neil, who some years ago carried out, in conjunction with Dr J. P. M'Gowan, an investigation into a recurring and fatal epidemic in an institution for boys near Edinburgh. At the post-mortem in such cases, in addition to the ordinary evidences of acute infection, a marked and diffuse lymphoid overgrowth was frequently found, so great as to justify a diagnosis of status lymphaticus. In view of my investigations I consulted Dr M'Neil, who told me that an inmate of the same institution was admitted to the Royal Hospital for Sick Children under his care, and eventually died with a rapidly growing malignant growth in the mediastinum.

Bowel.—Enlargement of the lymph follicles is common, especially in an advanced case, and the lymph masses can often be seen bulging on the peritoneal surface of the bowel as rounded bosses scattered along its length. This appearance is specially brought out after hardening.

Microscopically there may be an invasion of the muscle and mucosa, and in two cases I have found that the lymphoid mass had ulcerated through the mucosa into the lumen, where it was covered by inflammatory tissue (Figs. 24, 34). This is probably a commoner condition than these figures would represent, because, so far, a study of the bowel changes has only been made in a comparatively few cases.

On no occasion have I ever found adhesions between the affected bowel and the surrounding tissues.

Kidney.—In view of the diffuse character of the process, which, as we have seen, is associated with extensive infiltration of such organs as liver, spleen, lymph glands, etc., the kidney changes are, even in an advanced case, usually comparatively slight. This relative immunity is probably to be correlated with the fact that the mouse kidney possesses little or no lymphoid tissue normally. Whilst this is so, large deposits may on occasion be found in the perivascular areas (Fig. 27), and in two or three of my cases infiltration and destruction of the parenchyma is marked. In such cases it is possible

that we are dealing with a metastatic transmission of the neoplastic elements.

Lungs.—Perivascular areas of lymphoid overgrowth are common in the lungs, even in early cases. A certain degree of broncho-pneumonia is common, being most evident in the cases which die with toxic signs.

A remarkable appearance occasionally seen in the lungs consists of masses of round cells in the pulmonary vessels, the smaller of which may be completely plugged by the adventitious elements. This appearance is commonly found in areas of lung otherwise showing no abnormal changes (Figs. 29, 30). These cells histologically have the characters of the neoplastic elements found in the other parts of the body, and their presence under these conditions in the lung would seem to denote a metastatic transportation. As we have seen, the vessels of the liver may be plugged by the tumour cells, and the histological appearances strongly suggest that embolic detachment is constantly taking place. A process of this kind would amply account for the metastatic spread to the lungs.

Occasionally an invasion of the surface of the lung by a lymphoid mass growing in the mediastinum may be found.

Thymus.—In two cases a thymic tumour was present (mouse 5, thirty-one days; mouse 7, four and a half months). In mouse 7 the growth was of large size (Fig. 20). In many cases enlargement of the thymus is present. In the adult mouse the thymus is represented by scattered areas of lymphoid tissue and fat surrounding the structures at the base of the heart and root of the lungs. In an infected animal this scattered lymphoid tissue may exhibit evidence of hyperplasia in the shape of numerous mitotic figures, and in an invasion of the surrounding structures, large vessels, heart wall, etc. (Figs. 31, 37). I have noticed these changes as early as four days after infection.

In the case of mouse 7 the large thymic growth towards the base is found to be non-capsulated, and the proliferating cells are found to be infiltrating and destroying surrounding structures, muscle, vessel walls, etc. (Figs. 31, 32). At one part an extension to the meninges is present. In these tumours the Hassall corpuscles cannot be recognised.

Blood.—The blood has been examined by means of a drop obtained from the tail in twenty-seven positive animals. The examination is made when the animal is found to be ill, and the

fact that the majority die without warning explains the comparatively small number examined.

From an early stage in the research it became evident that the internal lesions are unassociated with any distinctive blood picture. As compared with the normal mouse blood film there was an obvious excess of white cells in one case only—mouse 18 (lived forty days). Here the count was: polymorphs, 48·5 per cent.; lymphocytic, 50·1 per cent.; eosinophils, ·25 per cent.; basophils, 0. The total count was not taken in this case. The normal count in the mouse as given by Gulland and Goodall is polymorphs, 23; lymphocytic, 71; eosinophils, 5·75; basophils, ·25. The average differential count over all the positive cases examined was: polymorphs, 36·4 per cent.; lymphocytic, 62·44 per cent.; eosinophils, ·69 per cent.; basophils, ·1 per cent. A total blood count was made in several selected cases, and confirmed the absence of any marked increase in the white cells. An animal with extensive lesions may have a total W.B.C. count of only 7000 to 9000 (normal in mouse, 5000). Polychromasia of varying degrees is common in the advanced cases.

The examination of the blood, so far as it has gone, marks off the cases from leukæmia and brings them rather into relation with so-called pseudo-leukæmia and lympho-sarcoma as studied in the human subject. The negative blood picture by itself, however, does not warrant any classification of the disease as based on analogy with the human subject for, in man and in an animal so low in the scale as the mouse, the pathological processes may be essentially different.

As we have seen, the organism is sometimes found in the circulating blood of positive animals.

Marrow.—The mouse marrow extends normally into the shafts of the long bones. For its examination the marrow from the shaft of the femur has been used. The bone is snipped through with scissors and a little of the marrow is expressed, dabbed on a glass slide, and fixed while fresh in Schaudinn's fixative.

In positive cases the marrow is pale, and microscopically it exhibits evidence of a marked lymphocyte increase. In many of the sections there are appearances suggesting an actual formation of lymphocytes *in situ*, and all stages between the large primitive cell and the small fully formed lymphocyte may be recognised.

A complete study of the marrow changes has, so far, however, not been carried out largely because of the difficulties inherent in this study. The marrow has not been studied in serial sections.

Skin.—In one case (mouse 11, three months) areas of ulceration appeared on the skin of the back and left side of the neck, which the animal was constantly scratching. On the surface of these patches small papilloma-like growths appeared, which under the microscope proved to be nodules of tumour tissue analogous to the infiltrating masses found in the internal organs of affected animals. The internal lesions in this animal were moderately marked. This animal was ill for a considerable time and appeared to be dying. It gradually improved and only at a later date developed the skin ulceration.

In another case (mouse 62, two months) a large flattened tumour was present in the subcutaneous tissues of the lower part of the abdominal wall (Fig. 22). It was adherent to the skin. Microscopically it proved to be a round-celled infiltrating tumour, the cellular elements of which were in a state of advanced necrosis, thus preventing a satisfactory histological study. This animal had widespread lymphoid lesions.

Experimental Injection of Human Organism.

Animals Employed.—Forty mice, 2 guinea-pigs, and 1 rabbit. The experiments with the animals other than mice have only been in progress for a few weeks; so far they are negative.

Study of Pathogenic Effects.—Five mice were injected into the left mammary region with a third generation subculture obtained from a mammary cancer. Results negative.

Thirty mice were injected intraperitoneally with a third generation subculture obtained from a metastatic cancerous tumour of the liver. Of these 3 have so far died after two months, two and a half months, and three months respectively, with diffuse lesions similar to those already described in animals injected with the mouse organism. That they are not examples of cage infection is supported by the fact that the whole series of animals used in this experiment were placed in new, previously unoccupied cages.

Five mice were injected intraperitoneally with a fresh culture of an organism similar to that which formed the

subject of the above experiments. It was obtained from a human leukæmic liver (see p. 253). All 5 animals died within thirteen days, viz., four days, 1 ; six days, 2 ; seven days, 1 ; thirteen days, 1. The four animals surviving six days and longer exhibited the naked-eye changes associated with diffuse lymphoma, *i.e.*, enlargement and mottling of the liver, enlargement of the spleen, and lymph masses in the mesentery. Microscopically the characteristic diffuse cellular proliferation was found in all 4 cases.

In all these cases an organism with characters similar to that injected intraperitoneally was recovered from the liver.

It is thus apparent that the human organism is capable of inducing in mice lesions similar to those caused by the mouse organism, a discovery that argues in favour of the identity of the two germs.

It is interesting to note that the organism obtained from the leukæmic source was more lethal than the organisms obtained from human carcinoma. But no deductions can be drawn from this isolated finding, because, as it happens, the cancer cultures were, in each case, several weeks old, whereas the leukæmic organism was used within a week of its recovery from the leukæmic liver.

In no case has carcinoma been obtained in mice injected with the human cultures.

Controls.—Each experiment was controlled. The animals were received from two dealers, and for each experiment a number corresponding to the injected animals was placed in separate control cages. To begin with the controls were broken so that the interpretation of the early results is somewhat vitiated. This arose in the following way. The first experiments, which were tentative (June to September 1921), comprise 37 mice and, as a large proportion of these died within a few days or weeks of injection without tumour development, they were discarded, and the fear that the results were due to contamination led to a negligent treatment of the controls, which were used up for subsequent experiments. It was not till October, when the first case of lymphoma was recognised in an injected animal, that the experiments first took definite shape. Thereafter the controls were rigorous.

In 2 out of the 11 control mice that have died lesions similar to those found in the foregoing series were found, consisting of a lymphoid infiltration of the liver, masses in

the mesentery, infiltrating lymphoid masses in the thorax, etc. These mice were control mice of an experiment in which 90 animals were taken soon after their arrival from the dealer. Thirty were injected with the mouse organism, 30 were injected with the human organism, and 30 were used as controls. Up to this time it was recognised that adequate safeguards against cage infection had not been taken. Owing to the limited number of cages available in the laboratory, the injected animals had often been placed in cages in which positive mice had lived. To remove this objection the 30 animals receiving the mouse injection and the 30 receiving the human injection were placed in new cages which had not been previously used. To confirm the control the control mice were, in their turn, placed in cages from which positive mice had been taken.

The two positive cases in the control mice occurred in one such cage in the course of two months. On the other hand, during the same time 14 positive cases had occurred amongst the 30 animals receiving the mouse culture and placed in the new cages.

These findings are a striking confirmation of the validity of the experiment, and they, moreover, demonstrate that, if cage infection does operate, it only operates to a comparatively small extent. The positive cases may, of course, be explained as merely a spontaneous occurrence of the disease, though the fact that they both came from the same cage argues in favour of cage infection. It is interesting to note that during two months 3 positive cases also occurred in the 30 mice injected with the human organism.

Another factor which the experiments do not completely settle is the degree of infection carried from positive animal to other animals in the same cage. Ordinarily, the positive cases are fairly evenly distributed over the cages, which contain anything ordinarily from 6 to 12 animals. In one experiment, however, whilst a large number of positive cases occurred in two cages, only 1 case occurred in the third cage. In another experiment one cage remained negative, whilst the three other cages developed a large number of cases. These discrepancies seem to be too great to be due to the operation of mere chance. They may possibly mean that the positive figures are being inflated by animal to animal infection in the same cage and, when it is recalled that some of the animals have ulcerating bowel lesions, which may imply infectiveness of the

dejecta, this possibility takes more definite shape. To control this possibility adequately would mean the segregation of the animals singly in cages, and this has not been practicable.

Percentage of Successes.—The earliest series dating over ten months and consisting of 19 mice are alone available for any deductions. Of these animals only 3 are still alive and therefore the experiments may be considered as complete or nearly complete. Of the dead animals—

2 developed carcinoma.
12 developed lymphoma.
2 developed no lesions.
16

It will thus be seen that 14 out of 19 developed a neoplastic change subsequent to injection, *i.e.*, nearly 74 per cent.

Recovery of Organism.—An organism microscopically similar to that injected has been recovered from the liver in all of 34 cases examined. In some instances it was also recovered from the spleen or blood or both.

The organism was recovered in pure culture from both of the cancerous growths found in the experimental animals.

Experimental Transmission from Animal to Animal.—The disease, so far, has been transmitted to the fourth generation, the organism recovered from one generation being used for the injection of the next generation.

Nature of the Infection.—The diffuse character of the changes suggests that a general blood infection is responsible for the process and this is borne out, not only by the fact that in animals, which die with toxic symptoms, the organism can be constantly obtained from the heart blood, but also by the occasional finding of the organism in the blood-stream of animals that live for a considerable number of months.

In the animals that die within a few days the organism in all phases can often be recognised in films and sections made from the scattered areas of lymphoid involvement. In several early cases, also, in such areas I have detected it within the protoplasm of the cells. On the other hand, in a chronic case the organism cannot usually be recognised even after tedious examination in a region where an obvious active proliferative change is in progress. Whilst this is so, a culture made from this tissue almost invariably results in a copious growth of the germ in the minute coccal and bacillary phase.

It would seem, then, that after the early stages of infection the organism enters into such intimate relation with the neoplastic tissue that it is effectively concealed from ordinary histological scrutiny.

That the organism grown from the tissues is not derived entirely from the blood contained in the organ (an objection that might be urged in view of the frequency of a continuing blood infection) is shown by the following observation. If a piece of liver (a convenient tissue for this observation because of its invariable involvement) be incubated in a fluid medium, to which a few drops of a ·2 per cent. solution of HCl are added, a free growth of the organism is obtained. A film made from the immediate proximity of the tissue fragment and stained with Leishman shows the germ in the disintegrating nuclei from which it can be seen emerging into the surrounding medium (Figs. 8, 9).

This observation I have made in all of ten livers examined. It is one that is at once easy and convincing.

We are thus forced to conclude that the organism has, during its parasitic phase, acquired the faculty of infecting individual cells and of living in a sort of symbiotic relationship with the cells which it inhabits. This conclusion, which I believe to be inevitable if the accuracy of the observations is granted, goes far to confirm the view, which I advanced in a previous paper, namely, that the organism lives parasitically in a minute phase, which is unrevealed by ordinary methods of staining. The study of the life cycle has demonstrated the actual existence of a phase so minute as to be easily obscured within the cell.

When placed in an altered but suitable medium the minute organism is induced to "throw back" into its larger forms and to grow out from the cell, and it is only then that it becomes visible.

As we have seen, also, the organism may exist in the tissues in large yeast-like forms which, under ordinary conditions, are indistinguishable from cell-nuclei and disintegrating cellular and nuclear material.

Leukæmia in the Human Subject.

The experimental findings suggested the advisability of carrying out an examination in human leukæmic patients. So far three have been examined, one (lymphatic leukæmia)

in the Royal Hospital for Sick Children, and two (myelogenous leukæmia) in the Royal Infirmary, Edinburgh. For the opportunity of examining these cases I am indebted to Drs Charles M'Neil and Chalmers Watson. In the three cases an organism similar to that previously isolated from human carcinoma has been obtained from the blood. In two cases the growth was meagre. In the third (myelogenous) the growth was free, and the same intracellular relation that I have demonstrated in the "aleukæmic leukæmia" of the mouse has been demonstrated here also (Fig. 7). One of the patients died subsequently to the blood examination, and a free growth in pure culture was obtained from the liver.

In all these investigations the cultures were made in an acid fluid medium under partial anaërobic conditions. The blood cultures could not be transferred to an aërobic slope. In the case of the liver culture, which was especially luxuriant, a free aërobic growth has been obtained.

This culture, as we have seen, when injected into mice produced lesions similar to those found with mice infected with the mouse strain.

Standing alone, the bacteriological findings in these cases of leukæmia would possess only a limited value. Taken in conjunction with the investigations recorded on the preceding pages, which led up to their discovery, they assume characters of considerable suggestiveness.

It will be noted that the organism was isolated not only in lymphatic leukæmia but also in the myelogenous variety, a fact that argues in favour of the common etiology of these diseases. Before a definite statement can be made, however, on this matter a more comprehensive study of the leukæmic conditions in the human subject is necessary.

Discussion.—The bacteriological investigations and the experimental results provide a considerable volume of evidence in support of the view that malignant disease and the related leukæmic phenomena both in the human subject and in the mouse are dependent upon an infection of body cells by an organism which, in each case, has specific characters. Whether the human and mouse organisms are identical and depend for their slightly differing morphological characters on the difference in the hosts is still undetermined. The experiments demonstrate that the human organism is capable of producing proliferative lesions in mice.

Experimental proof of the relationship of the organism to carcinoma is lacking in the sense that only in a small proportion of cases has a malignant epithelial growth been found in the injected animals.

The production, on the other hand, of a progressive and malignant neoplastic change in mesodermic cells in a large number of injected animals indicates that the mouse organism is capable of producing a true malignant tumour.

The neoplastic process as produced in the experiments is dependent upon a blood infection; it is essentially of a diffuse nature and seems to correspond to a hyperplasia affecting widely scattered areas simultaneously. Running side by side with this phenomenon there is, however, a tendency to an extension of the process by direct spread into non-lymphoid areas, and, as we have seen, the neoplastic cells, in addition, show a special predilection to invade the vessels, by which they may be conveyed to distant sites. In no instance, however, is there satisfactory proof that these transported elements may cause a true metastatic tumour. The tumours, wherever found, except perhaps in the kidney, where areas of infiltration may be found on occasion, are amenable to a local origin and, in the absence of greater proof, it seems unnecessary to predicate a metastatic source.

In this connection it is noteworthy that, despite the diffuse and intensive invasion of the blood-stream that characterises the histology of many cases, the round-celled content of the peripheral blood is, in most cases, little, if at all altered. Taken in conjunction with the fairly well-established absence of metastatic tumours, this may possibly imply that the neoplastic cells are rapidly killed once they gain entrance to the blood-stream.

The experiments suggest that in the healthy animal the only tissue that is capable of responding to the stimulus of the organism by proliferating in a malign fashion is the lymphoid tissue, which is presumably built up of cells that retain their embryonic power of free division into adult life.

In an earlier paper I made the tentative suggestion, which was based on a histological study of incubated tumour tissue, that in human carcinoma we were dealing with infection by an organism which passed one phase in the cancer cell. This has been followed in the present paper by the complete and convincing demonstration of such an intracellular phase in the

experimentally produced malignant phenomena of the mouse, and the two sets of investigations must be taken as together adding considerable evidence in support of the views which I have advanced.

It is conceivable that before an infection of epithelial cells can occur some alteration in their characters is necessary. This is in accord with the well-known clinical finding that carcinoma is often definitely preceded by a chronic irritation and inflammation of the corresponding epithelial surface. In carcinoma, as a rule, the proliferative process is limited to one tissue or organ, and a diffusion of the process is determined by a metastatic escape of cells from the local area of involvement. If carcinoma is dependent upon infection, the phenomena surrounding it would, unlike the experimentally produced malignancy recorded in the preceding pages, imply a process originating in a *local* cellular infection. Whether this infection is necessarily implanted from without or whether it can occur *via* the blood-stream, the experiments do not profess to indicate. A similar line of reasoning suggests that where a local infection of lymphoid tissue occurs, a local lymphoma or lympho-sarcoma will supervene.

Finally, the investigations incidentally provide data in support of the contention that the leukæmic phenomena and lympho-sarcoma are related to one another in regard to their ultimate etiology, and that these states are, on etiological grounds, related to ordinary malignant disease.

For constant help and guidance, I am indebted to Prof. James Ritchie, Dr J. W. Dawson, and Mr Richard Muir. The work was done in the Royal College of Physicians Laboratory, Edinburgh, and my grateful thanks are due to Col. M'Kendrick, the Director, for his advice in many matters.

The drawings were made by Mr John Grieve, and the micro-photographs by Mr Richard Muir. The other photographs were taken by Mr William Watson.

DESCRIPTION OF FIGURES.

FIG. 1.—*Human organism.* (*a*) Pale forms found during germination of cocci. (*b*) Liberation of granules. (*c*) Fused masses of large cocci liberating small cocci and bacilli. (*d*) Bacillary form. Stained with Leishman. × 1000

FIG. 2.—*Liver* showing extensive lymphoid infiltration. Mouse 7. Lived four and a half months (see Fig. 20). Eosin and methylene blue. × 150

FIG. 3.—*Human organism* showing characteristic appearances found in certain phase. Gametes? Stained with Leishman. × 2000

FIG. 4.—*Human organism.* Dark-staining clump of cocci above. Pale granular clump below. Stained with Leishman. × 1000

FIG. 5.—*Mouse carcinoma* incubated four days in acid fluid medium. Large blue body liberating organism in granular and bacillary phase. Leishman. × 1000

FIG. 6.—Blood from human *leukæmia* (myelogenous). Organism in filamentous phase in white cell and in surrounding medium. Leishman. × 1000

FIG. 7.—Cells from *liver* in positive mouse. Incubated twenty-four hours in acid fluid medium. Note organism in coccoid and bacillary form in and escaping from disintegrating nuclei. Film preparation. Leishman. × 1000

FIG. 8.—Cell from *liver* in positive mouse. Incubated twenty-four hours in acid fluid medium. Organism in large bacillary phase in and escaping from disintegrating nucleus. Small forms in surrounding medium. Film preparation. Leishman. × 1000

FIG. 9.—Four days' growths of *mouse organism* on agar.

FIG. 10.—*Human carcinoma* (uterus). Incubated forty-eight hours in acid fluid medium. Organism in coccoid form apparently in and escaping from nuclei. Drawing from film. Methylene blue. × 1200

FIG. 11.—*Human carcinoma* (breast). Incubated twenty-four hours in acid fluid medium. Organism in rod form in and outside nuclei. Drawing from film. Methylene blue. × 1200

FIG. 12.—Normal mouse.

FIG. 13.—*Mouse* 33. Lived twenty-four days. Note mottled liver and large spleen (white patches are high lights).

FIG. 14.—*Mouse* 38. Lived twenty-seven days. Note large spleen and lymph masses on thoracic wall.

FIG. 15.—*Mouse* 59. Lived six months. Note tumour on thoracic wall (adeno-carcinoma), mottled liver and large spleen.

FIG. 16.—*Mouse* 71. Lived three months. Note large spleen.

FIG. 17.—*Mouse* 88. Lived two months. Note large mottled liver and large spleen.

FIG. 18.—*Mouse* 92. Lived six days. Note large spleen.

FIG. 19.—*Mouse* 99. Lived three and a half months. Note mottled liver and very large spleen.

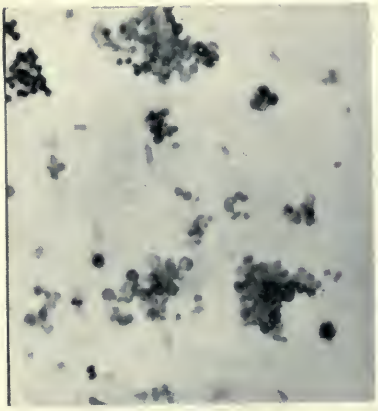
FIG. 20.—*Mouse* 7. Lived four and a half months. Note tumour of thymus (see Figs. 31 and 32), tumour masses in mesentery, very large spleen. Sections of the liver seen in Figs. 23 and 25.

FIG. 21.—*Mouse* 84. "Status lymphaticus." Lived six days. Note large thymus, mottled liver, lymph masses in mesentery. The spleen was enlarged also.

FIG. 22.—*Mouse* 62. Lived two months. Tumour in abdominal wall. Too necrotic for satisfactory histological study.

FIG. 23.—*Liver* showing perivascular area of proliferating tissue. Note mitoses. Cells passing into blood vessel. Mouse 22. Lived eight days. Eosin and hæmatoxylin. × 1400

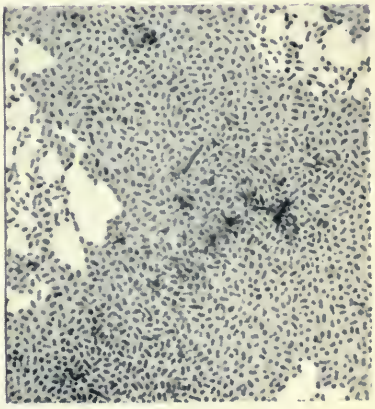
FIG. 24.—*Lymphoid patch in bowel* (see Fig. 34). Note mitolic figures. Hæmatoxylin and eosin. × 900



a

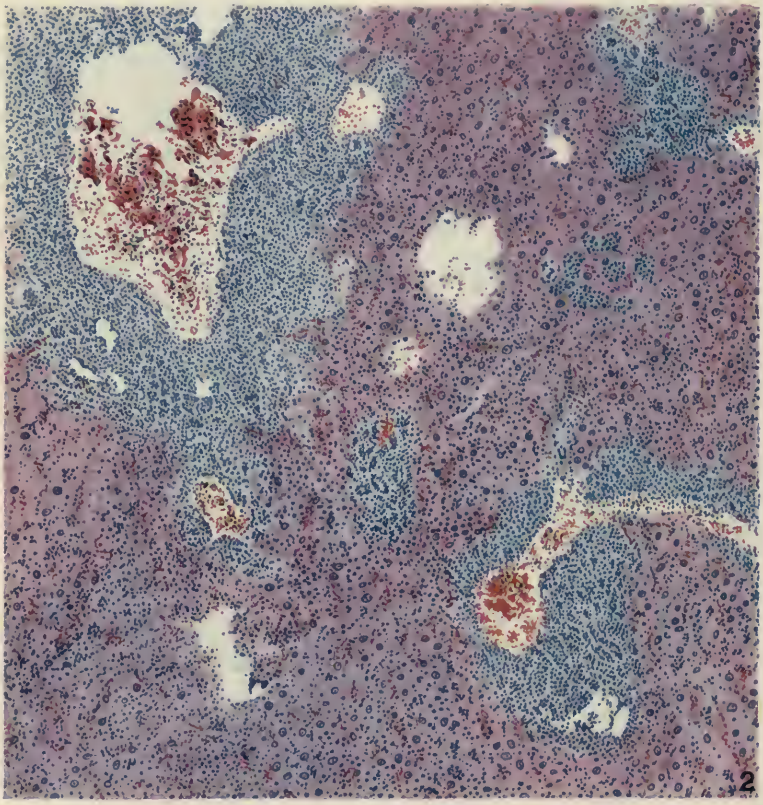
b

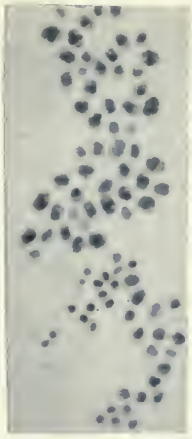
c



d

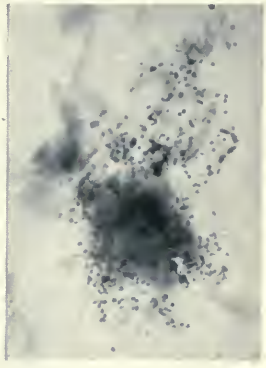
l.


2

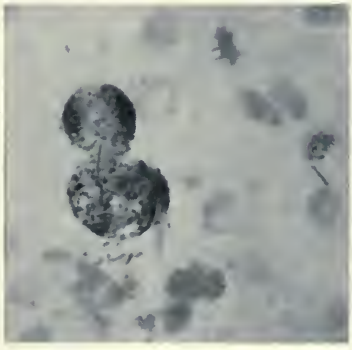


3

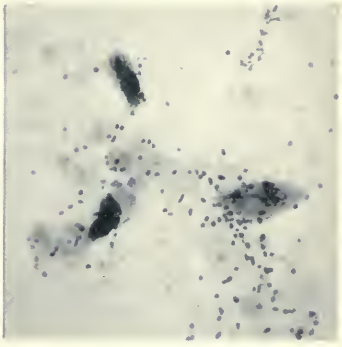
4



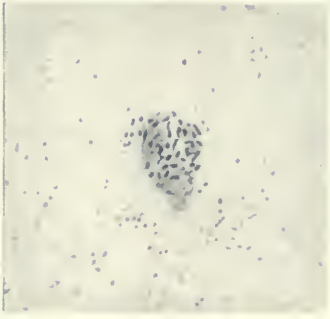
5



6

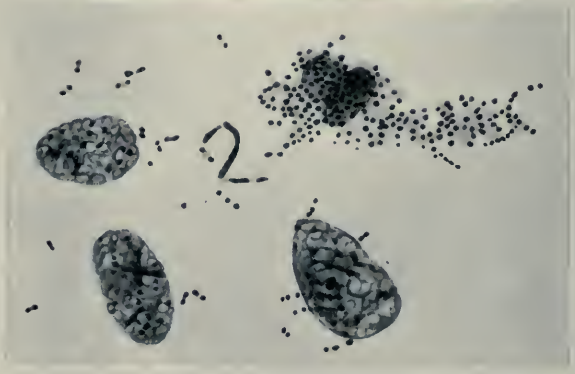


7

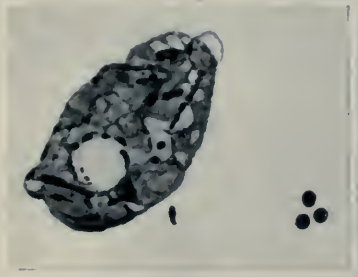


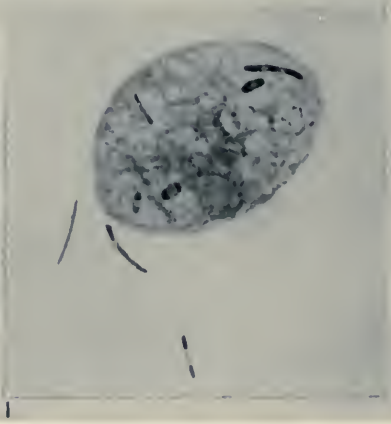
8

9



10

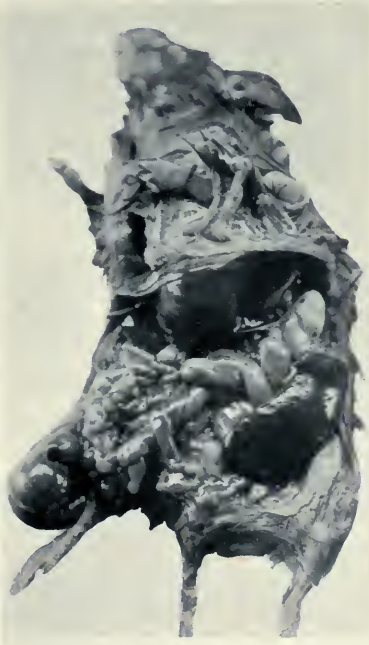




11

12

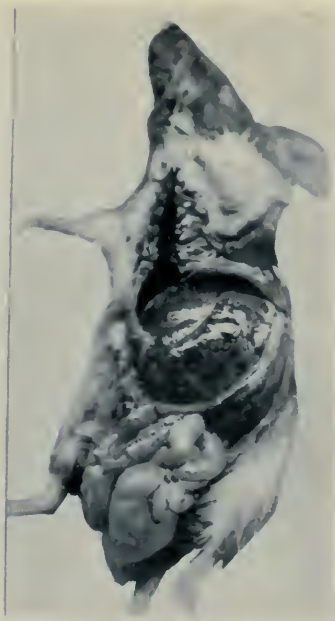
13



14

15

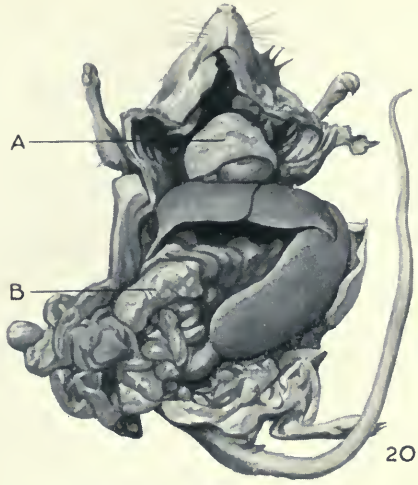
16



17

18

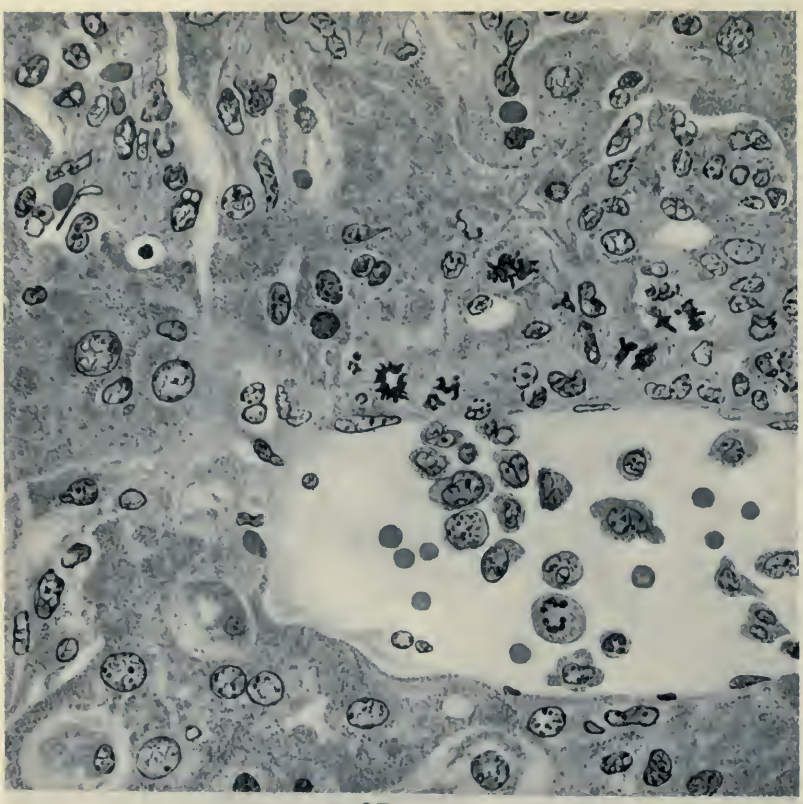
19



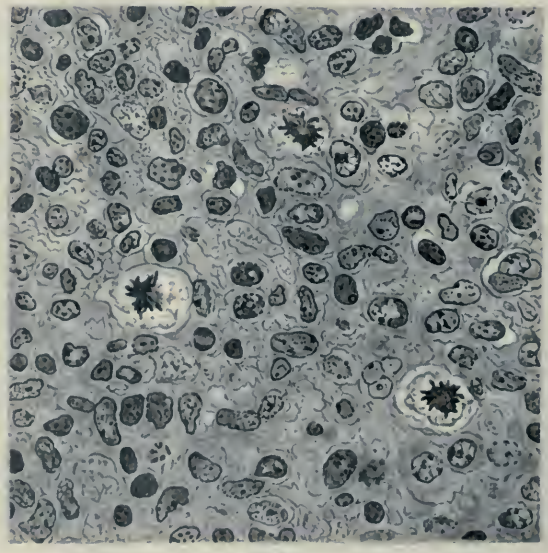
20

21

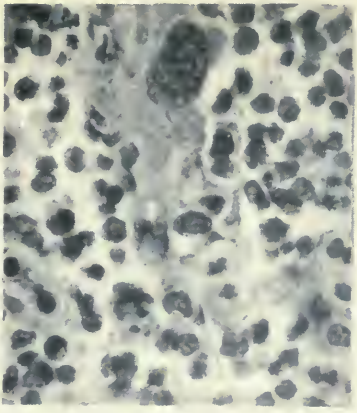
22



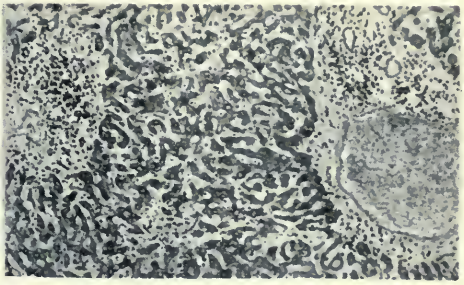
23



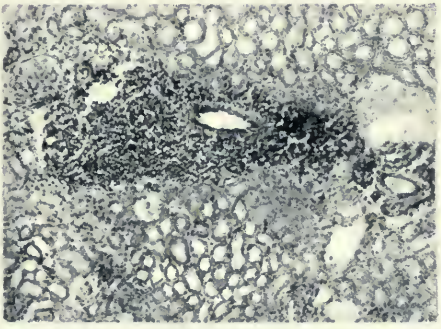
24



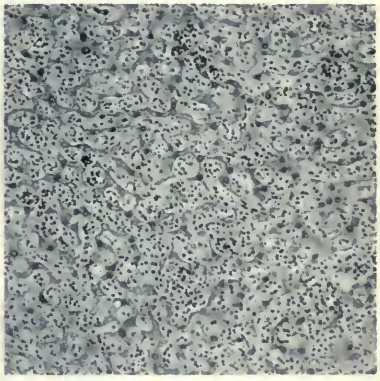
25



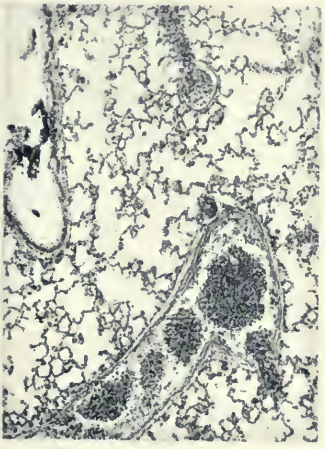
26



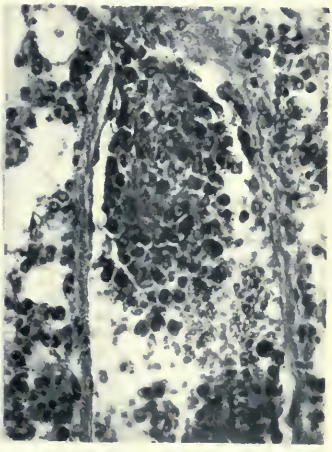
27



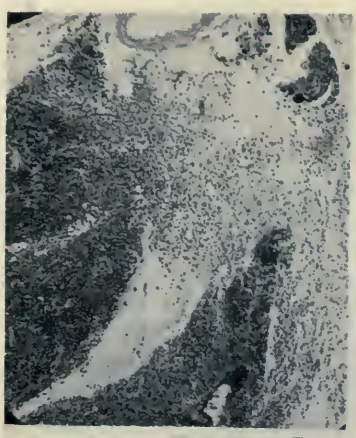
28



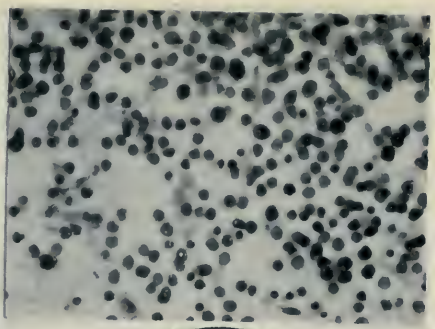
29



30

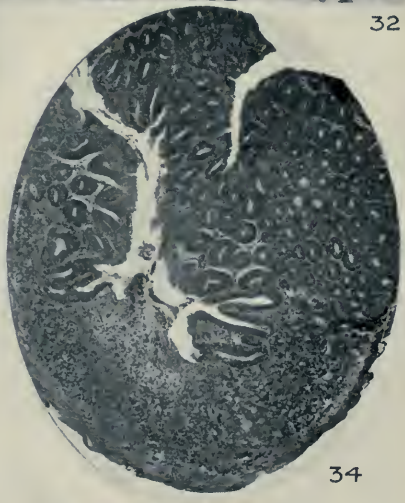


31



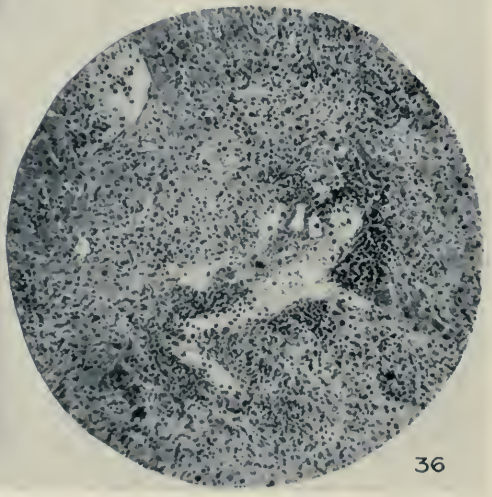
32

33



34

35



36

37

FIG. 25.—*Liver* showing character of infiltrating cells. Mouse 7. Lived four and a half months (see Fig. 20). Hæmatoxylin and eosin. × 500

FIG. 26.—*Liver* showing periportal lymphoid areas. Mouse 3. Lived forty-nine days. Hæmatoxylin and eosin. × 90

FIG. 27.—*Kidney* showing lymphoid area. Mouse 59 (Fig. 15). Hæmatoxylin and eosin. × 75

FIG. 28.—*Liver* showing hepatic capillaries crowded with lymphoid cells. Mouse 5. Lived twenty-nine days. × 90

FIG. 29.—*Lung* showing vessels containing masses of round cells. Mouse 45. Lived six days. Hæmatoxylin and eosin. × 60

FIG. 30.— Do. do. × 300

FIG. 31.—*Thymus*. Note lymphoid cells infiltrating surrounding structures. Mouse 7 (Fig. 20). Lived four and a half months. Hæmatoxylin and eosin. × 60

FIG. 32.— Do. do. × 400

FIG. 33.—*Lymphoid mass in mesentery*. Mouse 84. Lived six days (Fig. 21). Hæmatoxylin and eosin. × 12

FIG. 34.—*Lymphoid patch in bowel*, ulcerating on surface. Mouse 38. Lived twenty-seven days. Hæmatoxylin and eosin. × 30

FIG. 35.—*Lymphoid masses in mesentery*. Mouse 48. Lived seven days.

FIG. 36.—*Liver* showing extensive deposits of round cells. Mouse 22. Lived eight days. Hæmatoxylin and eosin. × 100

FIG. 37.—*Malignant lymphoma of thorax*. Note infiltration of muscle above. Vessels also invaded. Hæmatoxylin and eosin.

REFERENCES—[1] Young, James, *Trans. Edin. Obst. Soc.*, 8th June 1921 (*Edin. Med. Journ.*, 1921, New Series, vol. xxvii., p. 212). [2] *Journ. Path. and Bact.*, 1922, vol. xxv., pp. 151-2.

MYIASIS ŒSTROSA: BEING THE OCCURRENCE IN THE HUMAN SUBJECT OF THE LARVA OF *HYPODERMA BOVIS.**

A Vindication of Edinburgh's Priority of Recognition.

By DAVID M. GREIG, C.M., F.R.C.S.E., Conservator of the Museum of the Royal College of Surgeons, Edinburgh.

The *Hypoderma bovis* is the larval condition of a dipterous insect of the Class *Œstridæ*, an insect of about the size of and somewhat similar in appearance to a wild bee. In veterinary parlance these insects are spoken of as bot-flies, and in American literature are generally referred to as warble-flies. Their relationship to the affection of cattle has been recognised in Southern America since 1800. In our country the matter seems to have been introduced by a pamphlet of seventy-six pages, *An Essay on Bots of Horses and other Animals*, written by Bracy Clark, and published in London in 1815. This paper remains the classic on the subject, sure evidence of its fulness and its accuracy.[1] Our knowledge of the life-history of the *Œstridæ* has been amplified since then, but Bracy Clark's facts remain unaltered. Certain of these flies affect by preference certain animals. Thus, there is one which affects the horse, and as its larval stage is passed in the horse's stomach, it is called *Gastrophilus equi:* there is one which affects cattle, and as its larval stage is passed in the subcutaneous tissue, it is spoken of as *Hypoderma bovis:* there is one which lays its eggs at the horse's anus and whose larvæ are found in the rectum, and it is named *Œstrus hæmorrhoidalis:* there is one which affects sheep, and as its larval stage is passed in the nasal cavities, it is named *Œstrus nasalis* or *Œstrus ovis:* and the question has arisen, is there an *Œstrus hominis?* It is this question that more modern observation has settled in the negative. Sometimes the name *Gastrophilus* is used as a generic term, but I prefer the older nomenclature as being the more precise.

It will be necessary to refer a little more fully to the affection in animals before proceeding to the occurrence in man. As far as the horse is concerned, the matter became urgently prominent during the late war, and the Government issued an

* A Lecture delivered to the Fellows at the Royal College of Surgeons, Edinburgh, 2nd March 1922.

instructive pamphlet on the subject.[2] In this note Ritchie writes: ". . . nearly every horse examined after death in Morocco in 1913 contained over 1000 larvæ. More recent observations made during the war on German and Russian horses revealed the presence, as a rule, of from 500 to 750 bots in the stomach; while of eighty horses dissected between mid-February and mid-May 1916, fifty-five had died from the effects of bot-larvæ." The fly lays its eggs on the horse's hairs, especially of the knees, whence they are licked off and swallowed. The larvæ develop in the stomach and maybe in the pharynx, and burrowing through the mucous membrane, remain attached by their hooklets, and thrive on the blood and lymphatic vessels, much to the detriment of the host. Osler and M'Crae[3] endorse what has been particularly emphasised by French authorities, that *Œstrus equi* is the cause of a form of anæmia in the horse—"the infectious anæmia of the French"—and note that anæmia may be produced by extracts of these larvæ, "and apparently also when these extracts have been freed from hæmolytic lipoids." As the larvæ become pupæ, they are passed in the fæces, and a month later the fly emerges to recommence the vicious circle.

To our domestic animals, the most deadly bot-fly is the *Œstrus nasalis*, the destruction of the turbinate bones, and the inflammation set up, being ultimately fatal. According to Ritchie this is the rarest of the bot-flies in Britain.

The larva of the *Œstrus hypoderma bovis* has claimed attention during centuries on account of the destruction to the hides of the cattle affected. Holmes[4] writes: ". . . warble-flies cause much discomfort to cattle since the larvæ spend most of their life just below the skin. The full-grown larva may reach a length of an inch. When ready to pupate, it gnaws a hole through the skin of its helpless host and drops down and burrows in the ground. In this country (America) the damage done to hides is estimated at $50,000,000 per year." In Scotland, I am informed, quite 20 per cent. of cow-hides are more or less destroyed by these larvæ—a sufficiently serious economic situation. During the recent (1921) Meeting of the British Association for the Advancement of Science held in Edinburgh, Professor G. H. Carpenter read an interesting communication of what was being done in Ireland under his supervision, to gain experience and information which might lead to successfully coping with the pest. No *Œstrus* can sting,

bite, or suck blood. In Ireland, cattle are liable to be affected from January till June; but in Scotland, it may be as late as August or September. The *Hypoderma bovis* lays one egg at a time and attaches it to a hair. When the larva is hatched, it creeps along the hair and burrows into the skin, using the hair-follicle as a means of approach. Once in the subcutaneous tissue, instinct makes the larva burrow upwards, so as to avoid the parts on which the animal may roll. Having reached its destination the larva comes to rest, forms a small tumour, at the apex of which a little hole appears. To the margin of this hole the larva is attached by its hinder end, and through this opening it breathes by its spiracles and gets rid of its evacuations. The growth of the larva may be divided according to its size, etc., into four stages. A knowledge of these details is necessary to the understanding of the affection in man.

Bracy Clark makes no mention of the affection in the human subject, and Professor Carpenter, in reply to my interrogation, told me that though he and his workers are purposely living in an area where animal infection is common, he has no personal knowledge of a case of human infection. During the century which separates these observers, it has fallen to Edinburgh more than to any other city in Europe to elucidate the occurrence of this disease in the human body, a priority apparently unrecognised by authors.

In 1848 Dr G. W. Spence of Lerwick, Shetland, submitted to the Medical Faculty of the University of Edinburgh an "Inaugural Dissertation on the Medical Topography of the Shetland Islands." Therein he notes: "The comparatively rare disease, occasioned by the presence under the skin, of the larva of a species of the genus *Œstrus*"—and he refers to three cases which in 1818 had come under the observation of his father, who had practised in the same district. In May 1854 Dr Matthews Duncan exhibited at a meeting of the Medico-Chirurgical Society of Edinburgh[5] the larva of an *Œstrus* which he had extracted from the side of the neck of a girl aged 12 years. The patient had been employed during the summer of 1853 herding cattle in Perthshire, and had been frequently stung by insects. Dr Duncan apparently saw her in September 1853 and obtained the history, that with no previous ill-health, a lump had appeared at the back of the neck. This lump slowly changed position in various directions, a hole appeared, and a worm was squeezed out. Some weeks

later a lump appeared on the right side of the trunk, which wandered about subcutaneously till a hole appeared, and out of this, rubbing brought a worm. Lastly, a lump appeared over the spine, high up in the chest, and travelled up to the neck, where a hole formed, and Duncan extracted a half-inch larva of an *Œstrus bovis*. Professor James Miller seriously doubted whether the larva could move about under the skin, and apparently others received Duncan's statement with some scepticism, but subsequent events have proved that Duncan was quite correct in his observation. Duncan gives a fuller account of the affection in a later paper,[6] and he suggests that "the *Gastricolæ* or stomach-bots, and the *Cavicolæ* or face-bots, are probably not so rare in this country as is the skin-bot"—but he deals only with the last variety. He very poignantly writes that the best argument against a special fly for the human subject, is that the disease in man being so rare the species would necessarily soon become extinct. He also points out that the larva being easily expressed, is never allowed to come to maturity in man.

In 1857 the Sydenham Society issued the second volume of Küchenmeister's work[7] on parasites of the human body, and the paucity of clinical references therein, is efficient commentary on the rarity of the disease in Europe. He cites two cases "as yet the most certainly proved in Europe"—one from Poland, another from Muhlhausen, and a third is merely referred to from Iceland. In the first of these, Wendlandt extracted a white worm from the eyelid of a peasant boy aged 2 years, which was "the size of a caterpillar, with a hard skin"—a not very convincing description. In the second case, Leonhardt "saw a worble in the umbilical region of a man." No detail is given of the third case, but if the flies are in Iceland, as Millais[10] has described, the surprise would be not that it did occur, but that it occurs so seldom.

The statements contained in this volume of Küchenmeister's treatise brought Spence into the field, and in the *Edinburgh Medical Journal* of 1858-59 he published a most interesting local experience.[9] Besides learning of his father's familiarity with the disease, Spence saw, with Dr John Cowie of Lerwick, a girl aged 7 years, of good health till three or four months previously, when she began to be less lively than usual, and to lose her appetite. To those symptoms succeeded pains in various parts of the body, but always superficial. At each

painful spot a slight elevation of the skin was generally observable, with a blue ecchymosed line leading to it. Puncture of each elevation allowed of the expression of a small larva. One of these was sent to Professor John Goodsir, whose acumen as a zoologist was well known, and it was reported on by him as "the larva of a dipterous insect, probably of the genus *Œstrus*."

In 1874 Lee brought the case of a girl of 3 years under the notice of the Clinical Society of London.[11] Three weeks previously a red line had been noticed by the mother, below the right ankle,* and this line had travelled up the child's leg and thigh, on to the abdomen, with no pain, itching or discomfort, and from there it reached the right breast. During one observation it was seen to travel 4½ inches in twenty-four hours, so that it justified the name then given to it of "Creeping eruption." The Society could offer no explanation, so a sub-committee consisting of W. Howship Dickinson, Tilbury Fox, and Dyce Duckworth, was formed to investigate this marvel. After further observation, the child was anæsthetised and a portion of the *streak* excised and microscopically examined. The section is figured in the sub-committee's report, but no satisfactory explanation was arrived at. The wound, brought together by silver sutures, suppurated as wounds usually did in those days, and as no mention is made of the subsequent formation of a tumour with a hole in it, we may conclude that the suppuration, the dressings, the manipulation, and not least, the anæsthetic in the blood had produced the death of the larva.

The word "myiasis" is applied to an infection with the larval stage of dipterous insects, and Manson[15] writes: "Already we know over twenty species of diptera, whose larvæ have been found or expelled from the (human) intestinal tract," though, as in Cattle's case,[16] the larvæ are often recognised as *Œstridæ*.† Quite recently there has been published by Major Patton,[18] of the Edinburgh University Entomological Laboratory, a little technical monograph, perusal of which will bring realisation of the world-wide distribution of myiasis, but at present it is only the European affection we are considering and the clinical aspect of the subject does not come under Major Patton's purview. "Myiasis œstrosa" is the term employed by Fantham, Stephens, and Theobald in their recent work[12]

* The egg had doubtless been laid on the stocking.

† It is not surprising that intestinal myiasis is associated with a nervous disturbance. A bee in the bonnet is nothing to a bike in the bowels.

on the animal parasites of man. They admit the rarity of the disease in Europe, and state that no species of *Œstrid* is peculiar to man. "Although in America," they write, "as well as in Europe, *Œstrus hominis* was spoken of, up till the middle of last century, no such species exists." Myiasis œstrosa is more common in America than in Europe. "In Florida, Mexico, New Granada, Argentine, Brazil, Costa Rica, and other districts, and especially where large herds of cattle are kept, myiasis œstrosa has been observed in shepherds, huntsmen, and among the rural population." The eggs are laid on raw or abraided surfaces, and the tumour the *Hypoderma bovis* makes, may be as large as a pigeon's egg. These authors suggest that in man the infection of the nose, pharynx, or stomach, is by eggs of *Œstrus* laid on food. In the gastric affection the larvæ are got rid of by vomiting[21] (it is significant that a horse cannot vomit) and so is seldom serious, but it may give rise to colic, epigastric pain, pyrosis and vomiting,[19] and sometimes slight hæmatemesis.[20] Affection of the intestinal canal is less disturbing,[22] though it may give rise to symptoms simulating mucous colitis, but there is no abdominal tenderness to palpation. Fanthorn, Stephens, and Theobald state that "in Europe the first case was observed in Vienna by v. Neuman and Rille in a two-year-old girl in 1895," that is to say, seventy-seven years after Spence of Lerwick had recognised the condition and its cause, and forty-one years after an Edinburgh journal had published a full account and explanation of Matthews Duncan's case with historical notes on the disease in man! It seems unfortunate that three Cambridge savants should overlook the merits of fellow-countrymen to favour the glorification of aliens!

Through the kindness of Dr J. B. Simpson of Golspie, Sutherland, I am enabled to report the following hitherto unpublished case:—

"G. M., a female aged 2 years 9 months, the child of a stalker living in Dunrobin Glen, near Golspie, suffered in November 1918 from a slight swelling on the right side of the forehead. This was noticed by her mother. It disappeared and gave no further trouble. In January 1919 the child became peevish for a few days, but was not actually ill. At the same time the forehead began to swell on the right side. The swelling spread over that side of the forehead to the eyes, which were practically closed. There was no discoloration, but the right side of the forehead was tender. A small hole was then noticed in the centre of the original swelling, and on squeezing

this a small, pearly-white body jumped out and fell on the floor, where the mother was alarmed to notice that it moved as if alive. She put her foot on it and crushed it. She then sent for the doctor, but by that time (twenty-four hours later) the swelling had subsided. She was asked to report any recurrence and ten days later two swellings appeared, one on the top of the head in the mesial line and the other on the right occipital region. The swelling spread down to the nape of the neck, and the child complained of stiffness and soreness of the muscles. As in the former swelling on the face a small round aperture appeared, and on squeezing there, the larva escaped, moving actively. It was preserved for examination and sent to the entomological department of Edinburgh University, where it was recognised as the larva of a bot-fly."

Dr Simpson adds: "This is the first case of human infection by the bot-fly which has come under my notice, or which I have heard of, in this part of the Highlands. No doubt other cases have occurred, but if so, have not been recorded. The deer-stalkers round here inform me, that the red deer are sometimes excessively tormented by this fly, and on skinning the deer the hide is found to be perforated in many places."

One would expect that infection would take place through the exposed parts, but this is certainly the exception, as authors seem agreed that it is about the trunk, and especially the nates, that the disease first manifests itself, and this in properly-clothed adults as well as in imperfectly-clad children. In this respect the statement in the *British Museum Guide*[13] is of interest as regards *Œstrus ovis*, i.e. *nasalis*. "In Algeria," it runs, "especially in districts where sheep are few and the human population fairly dense, the sheep bot-fly attacks the Kabyl shepherds, laying its eggs while flying, in the eyes, nostrils, and lips; the larvæ when hatched cause intense irritation of the conjunctiva and of the cavities and sinuses of the nose and throat. The disease lasts about twelve days, and is known locally as *thim'ni*." This Kabyl word is apparently the same as *zimb*, which is an Arabic word meaning a fly, and is defined[17] as "a dipterous insect of Abyssinia, resembling a tsetse of more Southern Africa, to whose family it belongs, in being very destructive to cattle. It is somewhat larger than a bee and thicker in proportion." A recent case of ocular affection is reported from Constantinople.[23]

Myiasis nasalis may not of course be an œstrous affection, as, for example, in the repulsive summer-complication to advanced cases of lupus or carcinoma of the face, and there is not clear

evidence that the case of a girl aged 9 years, recorded by Küchenmeister,[8] was due to *Œstridæ*, though other larvæ were recognised. Hadwen and Cameron[14] believe the eggs of the *nasalis* to be laid on the inter-maxillary hairs, but this cannot be the case in children. Others held that the eggs are laid direct on the mucosa, while still others consider that human beings are not egg-carriers, but are attacked by the hatched larva. It has been shown that an active larva placed on the mucosa of a guinea-pig's mouth at once takes hold, burrows and ensconces itself in the submucosa parallel to the surface, but there is no evidence that the larva can wander about looking for a host.

It is the fact that, whether children or adults, females are more often affected than males. Spence suggested that the looser clothing accounted for this preponderance of the affection in women, and possibly the baldness of the female legs and thighs is the reason why the buttocks is generally the first site of irritation. Spence thought the young women became affected while working at peat-cutting, and resting, or sleeping, on the heather, where cattle had been herded. No patient of his remembered having been "stung." In children the hair of the scalp, in adults the hair of the genitals, may be where the eggs are laid, and the larva, true to its instinct, burrows upwards. The arrangement of subcutaneous tissue in the scalp itself does not lend itself to such burrowing, so the larva must travel forward to the face, or remain about the nape of the neck.

The recognition of the expressed larva has not always been easy, for it has been much smaller in size than the larvæ obtained from animals, and it was this smallness that made Gmelin conclude that man was attacked by a special species. The larva comes to anchor in its second stage and has yet two stages to go before it attains its full growth, and it is the second-stage larva which is expressed from the human subject.

As regards treatment of the condition in human beings, there is little to add. The gastric affection may be treated by emetics or washing out the stomach; if the affection is intestinal there may be no call for interference, or purgatives with antispasmodics may be used. In the nasal affection,[24] the indication is antiseptic nasal douching, or the administration of chloroform. In Dumesnil's case, quoted by Küchenmeister, the cure was materially assisted by encouraging the girl to smoke cigarettes. Finally the treatment of the subcutaneous affection is comparatively simple. In Brazil[12] it is said to be the custom to drop

tobacco juice into the "boil" and so kill the larva, but any escharotic or antiseptic would do, and the injection of chloroform or cocaine seems equally efficacious. Incision and expression have been already referred to; and an easy and effective mode of treatment seems to be freezing the skin with ethyl chloride.

Before tobacco, chloroform, or antiseptics were known it is conceivable that the disease may have had occasionally a fatal issue, and myiasis œstrosa may put a new interpretation upon, "he was eaten of worms, and gave up the ghost" (Acts xii. 23).

REFERENCES.—[1] Clark, Bracy, *An Essay on the Bots of Horses and other Animals*, London, 1815. [2] Ritchie, J., "Bot-flies of the Horse," *The Scot. Journ. Agric.*, vol. ii. No. 3, July 1919. [3] Osler, W., and M'Crae, T., *Principles and Practice of Medicine*, p. 728, London, 1920 [4] Holmes, S. J., *The Elements of Animal Biology*, p. 43, Philadelphia, 1921. [5] Duncan, J. Matthews, "The Larva of the *Œstrus bovis* in the Human Subject," *Month. Journ. Med. Soc.*, vol. xix. p. 80, Edinburgh, 1854. [6] Duncan, J. Matthews, "On the Occasional Occurrence of Bots in the Human Subject," *Edin. Vet. Rev. and Ann. Comparat. Path.*," vol. i. p. 275, Edinburgh, 1858-59. [7] Küchenmeister, F., *Animal and Vegetable Parasites of the Human Body* (Trans. E. Lankester, The Sydenham Society), vol. ii. p. 92, London, 1857. [8] Küchenmeister, F. (*op. cit.*), "Appendix by Translator," p. 246. [9] Spence, G. W., "On *Œstrus*, or *Affectio Bovina*," *Edin. Med. Journ.*, vol. iv. p. 417, Edinburgh, 1858-59. [10] Millais, J. G., *Wanderings and Memories*, p. 77, London, 1919. [11] Lee, R. J., "Case of Creeping Eruption," *Trans. Clin. Soc.*, vol. viii. p. 44, London, 1875. [12] Fantham, H. B., Stephens, J. W. W., and Theobald, F. V., *The Animal Parasites of Man*, p. 724-30, London, 1916. [13] *British Museum* (*Natural History*) *Guide*, No. 7, London, 1916. [14] Hadwen, S., and Cameron, A. E., "A Contribution to the Knowledge of the Bot-flies, *Gastrophilus intestinalis*, De G., *G. hæmorrhoidalis*, L., and *G. nasalis*, L.," *Bull. Ent. Research*, vol. ix. p. 91-106, London, 1918-19. [15] Manson, Sir P., *Tropical Diseases*, p. 859, 6th ed., London, 1919. [16] Cattle, C. H., "A Case in which Large Quantities of Dipterous Larvæ were passed per Anum," *Brit. Med. Journ.*, vol. ii. p. 77, London, 1906. [17] Annandale, C., *Ogilvie's Imperial Dictionary of the English Language*, London, n.d. [18] Patton, W. S., "Notes on the Myiasis-producing Diptera of Man and Animals," *Bull. Entomol. Research*, vol. xii. p. 239, London, 1921. [19] Bateman, T., "An account of Larvæ of two species of Insects discharged from the Human Body," *Edin. Med. Journ.*, vol. vii. p. 41, Edinburgh, 1811. [20] Chichester, J., "Two cases of Hæmatemesis connected with the discharge of Larvæ by Stool," *Edin. Med. Journ.*, vol. vii. p. 326, Edinburgh, 1811. [21] Pickells, W., "Beetles expelled from the Stomach," *Edin. Med. Journ.*, vol. lxvi. p. 384, Edinburgh, 1846. [22] White, W., "Case of a patient who discharged the Pupæ of the *musca cibitia*," with additional observations by J. Church, A.M., F.M.S., *Mem. Med. Soc. Lond.*, vol. ii. p. 67, London, 1879. [23] Gabrielides, A., "La myose oculaire à '*Oestrus ovis*' à Constantinople," *Bull. de l'Acad. de Med.*, 3.s. t. lxxxvii. p. 253, Paris, 1922. [24] Harrison, C. M., "Maggots in the Head," *The Medical Record*, vol. xxviii. p. 399, New York, 1855.

OBSERVATIONS ON SPINAL ANÆSTHESIA.

By D. N. KALYANVALA, M.R.C.S. Eng., Late Assistant Medical Superintendent, Chelsea Infirmary, London.

THIS clinical study is based upon observations of lumbar puncture performed for diagnostic and therapeutic purposes, and for the administration of stovaine anæsthesia in my surgical practice. The operations are detailed in Table I. The age of the patients varied from 22 to 80 years.

The Technique Employed.—The *blood pressure* is always taken as a routine before deciding on the administration of spinal anæsthesia. It is never administered if the blood pressure is lower than 100 mm. Except in emergencies, the patient is prepared as for general anæsthesia. This is done because occasionally it may be found necessary to administer whiffs of general anæsthesia along with spinal or, in cases of prolonged operation, when the effects of stovaine pass off.

Whenever possible, a modified form of omnopon and scopolamine anæsthesia (*twilight sleep*) is induced. The dose is regulated after careful examination of the patient's general condition, the state of the heart, lungs, and nervous system. The following routine has been found to be most efficacious. The hypodermic injections are given by the charge nurse, according to the following instructions:—(*a*) All preparations should be finished at least two hours before the operation. Under no circumstances should an injection be given if the surgical toilet is not completed. (*b*) Ascertain if the patient has passed urine or not. (*c*) The ward should be kept quiet and darkened by pulling the blinds down, and screening the bed. (*d*) The patient should be gently blindfolded with a dark coloured handkerchief, and the ears should be plugged with cotton-wool, preferably soaked in oil. When doing this the patient must not be frightened, and should be told that all this is done with a view of procuring complete rest and drowsiness. If the patient's confidence is not gained the aim may be greatly frustrated. (*e*) Before administering injections the pulse and respiration should be taken, and the colour of the face noticed. If the pulse is below 55, or the respirations be distressed, or if there is any cyanosis of the face, no more injection should be given, and the medical officer should be summoned at once. Occasionally, flushing of the face may be

noticed, but this need not cause any anxiety. If the patient complains of thirst, sips of water may be given.

The first hypodermic injection of 1 c.c. solution of omnopon (gr. $\frac{2}{3}$): scopolamine (gr. $\frac{1}{300}$) is given one and a half hours before the operation; the second injection of 1 c.c. solution of pure scopolamine (gr. $\frac{1}{450}$) half an hour later; while a third injection of 1 c.c. solution of scopolamine (gr. $\frac{1}{450}$) is administered half an hour previous to the operation.

Personally I prefer omnopon to morphia, and scopolamine to hyoscine or atropine. I have had two cases of hyoscine delirium. In one case the patient was so troublesome during the operation that general anæsthesia had to be administered (Case No. 21). As a rule three injections are required to procure satisfactory results, although occasionally a fourth may be necessary, whereas in many cases, especially amongst exhausted subjects, only two will be required. Invariably the results were satisfactory. On several occasions, although the patients spoke and even answered questions rationally during the operation, after the anæsthesia had passed off they remarked that they did not even remember being removed to the theatre. Thus, the aim of these injections is to procure *amnesia.*

I have found the administration of omnopon and scopolamine equally beneficial when used with general or local anæsthesia. In a case of an old woman suffering from carcinoma of cæcum, owing to low blood pressure spinal anæsthesia was not considered suitable. The usual resection of the bowel with subsequent anastomosis was performed under combined local and general anæsthesia. Although the patient complained of pain during the injections of local anæsthesia, next day she did not remember anything. In another case of a large ovarian cyst complicated with enlarged thyroid and marked nervous and cardiac irritability, owing to the difficulty of flexing the spine, the puncture was unsuccessful, and I had to perform the operation under general anæsthesia. When the patient came out about three hours after the operation she missed the abdominal swelling, and asked her daughter if the operation had been performed. When told everything was over, she most emphatically denied having ever left the bed. It is in cases of highly nervous conditions that omnopon and scopolamine sleep has proved most beneficial, and its use is specially indicated when spinal or local anæsthesia is administered.

After the administration of omnopon and scopolamine the

patient is gently removed to the operation table, and the blood pressure taken. The patient is turned on the side, the skin and the tract of lumbar puncture are properly anæsthetised with B. eucaine adrenalin solution and the puncture made. As soon as the cerebro-spinal fluid appears the *intra-spinal pressure* is recorded by a special manometer, devised by myself and made by Messrs Allen & Hanbury (Fig. 1).

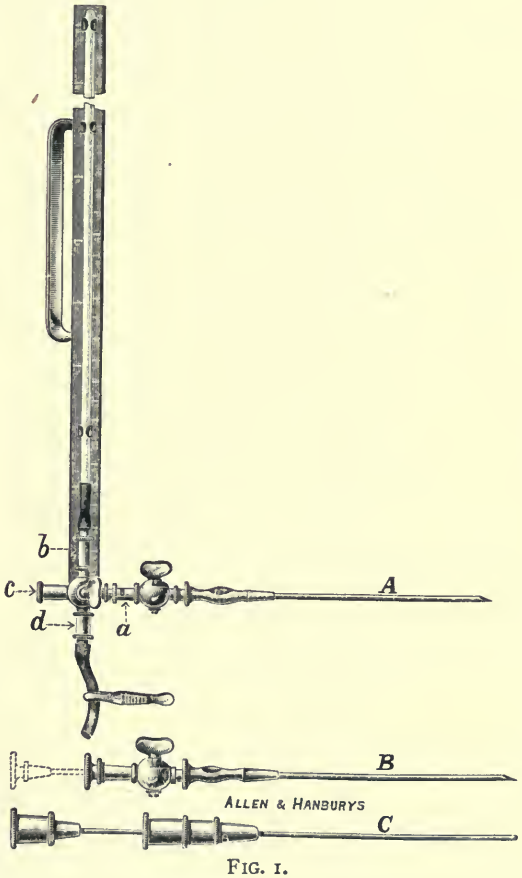


FIG. 1.

With a view to determine how far the changes in the intra-spinal pressure are responsible for different complications, I have been using this manometer as a routine with all lumbar punctures performed either for diagnostic, therapeutic, or for stovaine anæsthesia purposes. The principle of this apparatus is simple, and it fits on to a standard Barker's needle.

Apparatus.—It consists of a standard Barker's needle fitted with a stopcock and an extra long stilette (Fig. 1, B.)

For intra-spinal medication purpose a special cannula with an air-tight mount (Fig. 1, C). This can be attached to the stopcock. A special manometer graduated in inches and centimetres (Fig. 1, A) is attached to a three-way tap having four arms, *a*, *b*, *c*, *d*. The scale is made in two parts, each 20 cm. (8 ins.) long, and is fitted with glass tubing 2 mm. in diameter. The arm *a* can be attached to the stopcock of the needle when the pressure is taken; *b* is in communication with the glass tubing by means of a rubber connection; *c* is the arm which can be used when any intra-spinal medication is given; and *d* is the exit tube with a clip.

Directions.—The whole apparatus, which can be very easily separated into different parts, is boiled in sterile water, *no soda* being used. The manomcter is fixed as in diagram A, any water in the apparatus shaken out gently. The needle with the stilette, and stopcock (Fig. 1, B) is taken and the puncture made. On removing the stilette, if the puncture is successful, cerebro-spinal fluid will appear. As soon as this is noticed the stopcock is closed to prevent any escape of the fluid. Next the manometer is attached and the stopcock opened. The fluid rushes in the arm *a*, and the tap being three-way it will immediately rise in the manometer through arm *b*, arm *d* being shut off by means of a clip. The pressure is read and can be reduced by releasing the clip on the exit tube *d*.

Having lowered the pressure to desired level, the tap is turned so that the passage *b* is closed but open from *a* to *c*. The injection of the medicament can be made through the arm *c*, either by the gravitation method or by means of a syringe.

If it is not required to take the intra-spinal pressure during the actual injection of the solution, as in the case of stovaine anæsthesia, the manometer may be removed and injection can be made through the needle with the stopcock attached.

I think this instrument would be a good adjunct in all lumbar punctures. By using it I have been able to ascertain more accurately the intra-spinal pressure with its diagnostic and prognostic value, and also in determining the quantity of the cerebro-spinal fluid to be withdrawn. In this paper I shall only discuss the intra-spinal pressure and its relations to spinal anæsthesia.

The normal intra-spinal pressure is 4 to 6 in. (10 to 15 cm.). Of course there are other factors which may influence the pressure to a certain extent, *e.g.* in the sitting posture it is higher than in the lateral posture, varying from 6 to 8 in. If the head is extended the pressure may be increased from 2 to 3 in. Coughing, crying, straining, or any other factor causing forced expiration will increase the pressure from 2 to 4 in. If the pressure be higher than 6 in. a little fluid is withdrawn, but if lower than 5 in. the injection of stovaine is made without withdrawing any fluid. I will presently explain the reason for doing this.

The *dosage* of stovaine is regulated according to the condition of the patient and of the intra-spinal pressure, and not merely according to the nature of the operation. In debilitated subjects, or when intra-spinal pressure is low, it is advisable not to give more than half the dose, *i.e.* ·5 c.c. of stovaine saline, or 1 c.c. of stovaine glucose solution. It may be repeated, if necessary, though in most cases a few whiffs of A.C.E. or ether would be sufficient to finish the operation. It is always a safe procedure to keep in the syringe the exact quantity of solution which is to be injected. The injection should be made gently.

As a rule the space between the twelfth dorsal and first lumbar spines is selected for operations above the level of the umbilicus, and between the second and the third or the third and the fourth lumbar spines for operations below that level.

In many cases of operations above the level of the umbilicus during manipulations of viscera it was found necessary to administer whiffs of A.C.E. or ether in addition. There is no risk in doing so; in fact, ether improves the pulse and the blood pressure.

As regards the choice of the stovaine solution I have been more successful with 10 per cent. stovaine saline solution. I prefer to use this solution for the following reasons:—Firstly, for uniformity of diffusion and action irrespective of the position of the patient. Whenever glucose stovaine solution is used, unless the operation is on the perineum, the sitting posture is to be avoided. The solution seems to have a distinct tendency to get fixed in the sacral sac, and owing to its low osmotic pressure in spite of tilting up of the pelvis the diffusion is very slow—in some cases even failing to reach the desired level. In one case it took twenty minutes to anæsthetise

the level of the groin (Case No. 2.) This tedious waiting is done away with when stovaine saline solution is used, and the diffusion is decidedly more satisfactory and equal on both sides. I consider this to be a distinct advantage, especially in abdominal and gynæcological operations.

Secondly, in about five minutes after the injection of the stovaine saline solution the patient can be kept flat or placed in Trendelenburg's position. When injected in the lateral posture it diffuses in both directions, and about 10 to 12 in. upwards from the site of injection. The maximum height of diffusion is obtained within three or four minutes, after which time a change of posture has no influence. It is therefore of great use in gynæcological operations, and of some value in ameliorating the symptoms arising from a fall of the blood pressure. It should be remembered, however, that for the first five minutes the head and shoulders ought to be slightly elevated. Contrary to general belief, this solution is more hypertonic than stovaine glucose solution. It was this error that was partly responsible for both the cases of disturbed respiration which I shall presently describe, and which caused me to make further investigations into the physical properties of this solution. Possibly it is called light because of the safety of the position which can be adopted soon after the injection, and also of its diffusibility. In fact it is heavier, having the specific gravity of 1·084 at 60° F., whereas the specific gravity of glucose stovaine solution is 1·023. The specific gravity of normal cerebro-spinal fluid is 1·007. The diffusion is more rapid with stovaine saline solution because of its higher osmotic pressure.

The determinations were made by Barger's microscopic method, alternate drops of the solution under test and of a standard cane-sugar solution being introduced into a capillary tube; the concentration of sugar required to produce the least relative change in volume of the drops was then found by successive trials. The table following gives the strengths of the sugar solutions which were found to be isotonic, and from these the osmotic pressures and freezing-points have been calculated by interpolation from the results of Berkeley[1] and of Ewan.[2] For these figures I am indebted to Dr Barr of the National Physical Laboratory.

Besides this there are other factors which play a part in the diffusion, *e.g.*, the force with which it is injected, and the

intra-spinal pressure of the cerebro-spinal fluid. If the pressure is low there are chances of rapid and high diffusion of solution. I noticed that whenever the intra-spinal pressure was low, diffusion was high. In a case of so-called "dry-spine," where only a few drops of cerebro-spinal fluid appeared after the patient was made to cough, the diffusion was high, although a small dose of stovaine was administered (Case No. 74). In the last series of 66 cases, pressure under $2\frac{1}{2}$ in. was noticed in 14 cases, diffusion in all was rapid and up to, or even higher than, the xiphisternal notch. So whenever pressure is low, it is safer not to withdraw cerebro-spinal fluid, nor to administer more than half a dose, also to keep the head elevated a little longer than in ordinary cases.

	Concentration of Isotonic Sugar Solution.	Osmotic Pressure.		Depression of Freezing-Point.
		At 0° C.	At 36°·9 C.	
		Atmos.	Atmos.	
Stovaine-billon saline .	116·6 gms. = ·341 moles per 100 gms. water	105·8	120·4	8°·6 C.
Azoule: stovaine glucose .	10·95 gms. = ·032 moles per 100 gms. water	7·51	8·51	0°·64 C.

I have seen no difference between the two solutions in the duration of anæsthesia. Using stovaine saline solution I have performed operations, *e.g.*, Wertheim's hysterectomy, with complete satisfaction. Perfect relaxation was maintained for about fifty minutes, after which general anæsthesia was administered to finish the operation.

Throughout the operation the anæsthetist takes the blood pressure every five minutes, and informs me when it falls below 90 mm. On receiving this warning, immediate measures are taken to raise the blood pressure. After the operation is finished, the patient is gently removed to the bed and laid flat with a soft pillow under the head. The room should be kept dark and quiet. Patients who are deeply under the effects of omnopon and scopolamine are carefully watched by a nurse, who is instructed to draw the jaw forward or to pull out the tongue if there is any evidence of obstruction in the air passages. Unless Fowler's position is absolutely indicated, the head should be kept low for at least twelve hours, and then the patient may be propped up.

(*To be continued.*)

OBITUARY

Professor F. D. BOYD, C.B., C.M.G.

Moncrieff-Arnott Professor of Clinical Medicine, University of Edinburgh.

Francis Darby Boyd was born in Edinburgh in 1866. He was the sixth son of the late Mr John Boyd, a member of the well-known firm of Oliver & Boyd, Publishers, who was for over fifty years a Manager of the Royal Hospital for Sick Children, and for a time of the Royal Infirmary. It was probably this connection that turned his thoughts to Medicine, though the fact that "Joe" Bell was the family doctor, and as Editor of this *Journal* on very intimate terms with Mr Boyd its publisher, may have unconsciously influenced him. At all events his brothers and sisters knew quite early in his career that Francis was going to be a doctor.

He began his education like so many of Edinburgh's now prominent citizens at "Henderson's" preparatory school in India Street, and from there passed on in due course to the Edinburgh Academy, which he left from the Sixth Class in 1883 to begin the study of Medicine in the University. He did not greatly distinguish himself in his school classes, being greatly hampered by a severe stammer, but he was a member of the XV. and of the Rifle Team. He graduated M.B., C.M. in 1888 and M.D. in 1893, being awarded one of the Gold Medals of the year for his Thesis on "Some Points in the Pathology of Albuminuria."

After graduation he acted as Resident Physician under Dr Brakenridge in the Royal Infirmary, then followed six months' residency in the Royal Hospital for Sick Children, and three as Senior Resident Physician in the Glasgow Maternity Hospital. Having acquired this amount of clinical experience he next turned his attention to the scientific side of his profession, and began that work in the Laboratory of the Royal College of Physicians, which he continued with little intermission for the rest of his life.

About this period he had a short experience of country practice in Selkirk, when he formed one of a long line of afterwards distinguished doctors who have assisted that veteran Border physician, Dr J. S. Muir. Dr Muir has been good enough to refer to his diary of thirty-two years ago, and he tells me he finds the following entry "a quiet self-possessed fellow with a slight stammer," and when he left "having got through his work very smartly." Then followed a period of study in the Pathological Institute of Berlin and of Bacteriology in Günther's Laboratory.

He put up his plate in Edinburgh in 1890 and acted for several years as assistant to his father's old friend Joe Bell, and later for a time to Dr John Playfair, and he early obtained appointments as

From a Copyright Photograph by] [*A. Swan Watson*

PROFESSOR F. D. BOYD, C.B., C.M.G.

Physician first to Marshall Street and then to the New Town Dispensary, where he soon became a popular teacher. Then came a stroke of good fortune. In 1897 George Gibson was promoted to the full physiciancy in the Royal Infirmary and resigned his position as Physician to the Deaconess Hospital, which he had held since that Institution was opened. The Directors gave much thought to the selection of his successor, and after careful deliberation decided to offer the post to Boyd, and he thus at the age of thirty-one obtained charge of hospital beds.

His next adventure was with the Edinburgh and East of Scotland Hospital in the South African War. The Hospital left Edinburgh with Prof. Chiene in charge, Mr (now Sir David) Wallace second in command, and Boyd as Physician. But shortly after arrival in South Africa Mr Chiene was appointed Consulting Surgeon to the Forces, Mr Wallace was laid low with enteric, and Boyd had full charge. That war, as will be remembered, proved to be a medical rather than a surgical war, and Boyd rose to his opportunities and did excellent work in the hospital at Norval's Pont. For his services he was mentioned in despatches and appointed a C.M.G.

His connexion with the Royal Infirmary was resumed in 1893 when he was appointed Clinical Tutor to the Extra-Mural Physicians, an arduous post which has been filled by many distinguished Edinburgh men. The post no longer exists: it may be worth while recalling that it called for two hours' hard tutorial work on four nights each week between the exceedingly inconvenient hours of 7 to 9 P.M., during both Winter and Summer Sessions, for an annual honorarium of £50.

In 1899 he was appointed Assistant-Physician, and discharged the duties of that post with singular faithfulness till in 1913 he was promoted full Physician with charge of wards. His sixteen years' experience at the Deaconess here stood him in good stead, and he very soon became popular with the students and had large followings.

His tenure of the Moncrieff-Arnott Chair of Clinical Medicine, which carries with it the Chairmanship of the Clinical Medicine Board was all too short, but he gave evidence of organising power and tact which promised to be of great value in the school.

He played his part in the Great War. He was Major à la suite of the Second Scottish General Hospital, and was mobilised soon after the outbreak of war and served first at Craigleith and later at Bangour. He volunteered for Foreign Service early in the war but it was not till Spring 1917 when the Germans began their devilish attacks on Hospital Ships in the Channel, and the Army called for more hospitals to be established in France, that his offer was accepted, and he went out in

Medical charge of the 58th General Hospital. When his term of service there was over he returned to Edinburgh and continued his duties at Bangour till he was appointed a Consulting Physician to the Forces in Egypt and Palestine with the rank of Col. A.M.S. There he discharged his onerous and varied duties with his usual capacity, and his period of 12 months' service in the East will always be associated with the Report of the Commission on Pellagra (Govt. White Paper) among the Turkish prisoners (and others) over which he presided. For his services in the East he was again mentioned in despatches and was granted the Companionship of the Bath (Military Division).

This obituary would be incomplete without a reference to the difficulties which he overcame. He almost entirely conquered a stammer which seriously interfered with his progress in his earlier years; he subdued and kept in complete control a rather fiery temper, and he shook off an Edinburgh West End manner which was rather marked in his early twenties.

But all his early life was a contest with difficulties. From a position of affluence the Boyd family was brought to the verge of ruin by the failure of the City of Glasgow Bank in 1879. But Mr Boyd—a true Scot—determined that whatever else suffered the education of his sons must not, and Francis was enabled to complete his career at the Academy. But when he left school the question of whether it was possible for him to follow his ambition to be a doctor had to be seriously debated. Then and there at the age of eighteen Boyd faithfully promised that if the money for his medical education could be raised he would repay every penny of it. And he did. Few of his friends knew, when they wondered why he continued the rather monotonous work of Certifying Factory Surgeon and Medical Officer to two or three Lodges of Oddfellows and Mechanics, that so worthy a motive actuated him.

He had the first symptoms of his fatal illness just about a year before his death, and by July he knew that he was doomed. But he would not give in, and in spite of his heavy burden he carried on his work, teaching, Insurance, Consulting, and the Chairmanship of the Clinical Board, with a heroic devotion which was the admiration of all.

A proud record of hard work well done, and the Edinburgh School profoundly mourns his loss.

He married in 1904 Constance, daughter of Alfred Lepper, Esq., Carrickfergus, by whom and by two daughters he is survived.

NORMAN WALKER.

NEW BOOKS

The Practice of Medicine in the Tropics. Edited by Lieut.-Col. W. Byam, O.B.E., and Major R. G. Archibald, D.S.O. Vol. I. Pp. xxii + 856 + 106 (indices), with 370 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price 84s.

This treatise is the outcome of a laudable endeavour on the part of the editors and publishers to present to the average medical man in the tropics a compendium which, without being encyclopædic, is sufficient for his needs in that no information of practical value has been omitted. It is intended to serve as an introduction to the leading teachers of tropical medicine in countries where the English language is spoken. A glance at the list of contributors, seventy-eight in number, is sufficient to show that this intention has in general been achieved. We may perhaps be permitted to regret that the Royal Society's Plague Commission is not represented.

The various articles of the volume under review are characterised by a high degree of excellence. The leading section on hygiene and minor tropical hygiene is from the pen of Andrew Balfour. It is written with the versatility and thoroughness which characterise this distinguished writer. The chapters are full of information; there is hardly a redundant sentence; and yet they are so interesting that they will appeal to all who have lived under tropical conditions, or have seen service in the field.

The second section by Yule Walsh relates to tropical aspects of nursing and contains much useful information.

In the third section we have a very complete treatise on medical entomology. It has been planned and edited by Lloyd. Both he and the authors whom he has selected are to be congratulated on the result of their labours. All arthropods associated with the conveyance of disease are fully dealt with, as regards their anatomical structure and bionomics, as well as the means by which they may be controlled. The chapters by Lloyd on Lice, by Lloyd and Patton on the Blood-sucking Muscidæ, and by Malcolm Watson on Mosquito Control, are especially worthy of note. The schemes for identification of Anophelines, collected from various writers, and subdivided into geographical areas, given by Carter in his chapter on the Blood-sucking Nematocera, will be especially useful to the tropical sanitarian.

The fourth section deals with laboratory methods. The technique of bacteriological, histological, and pathological methods is very fully and adequately described by Archibald. A short chapter by D. Harvey introduces the subject of Sera and Vaccines. It leads us

to hope that this experienced worker will have freer scope when he comes to deal with enteric fevers in the forthcoming volume. Chapters on Blood Transfusion, and the Organisation of Anti-variolous Establishments complete this important section.

Snakes and snake poisoning by Acton and Knowles forms another very interesting section. The volume closes with chapters on Vegetable and Fish Poisoning by Scott, and Medico-Legal Toxicology by Colles.

The illustrations are excellent, and the editors are to be congratulated upon the completeness of the indices. A limited bibliography is appended to each article.

Bowel Diseases in the Tropics. By Sir LEONARD ROGERS, F.R.S. Pp. xvi+475, with 72 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price 30s. net.

The present volume combines the author's well-known books on Cholera and the Dysenteries and includes much new matter, especially as regards etiology and treatment. The section on cholera, which displays an extraordinary wealth of detail as regards epidemiology, etiology, prophylaxis and clinical description, is admirably clear and precise in the recommendations with regard to treatment. Amœbic dysentery receives adequate consideration, and a couple of beautifully realistic coloured plates illustrate the appearances of the bowel in this disease. In the chapters on bacillary dysentery, it appears to us that adequate recognition is not made of the very serious cases of bacillary dysentery which are complicated by malaria, and of the great importance of combating this complication by prompt treatment. We note also that the author prefers milk to beef-tea in all acute dysenteries, a dietetic point about which there is some difference of opinion. An excellent index concludes a volume which is of exceptional merit, and one which forms a classic text-book on the subjects discussed.

The Oxford Index of Therapeutics. Edited by VICTOR S. SORAPURE, M.B., Ch.B., F.R.C.S.(Edin.) Pp. xvi+1126, with 111 illustrations. London: Henry Frowde and Hodder & Stoughton. 1921. Price 42s. net.

This work contains articles by seventy-five writers, each a specialist in his own department of medicine. The book is an attempt to provide for the general practitioner a mine of information in handy form. Each writer has placed himself in the position of a consultant giving direct and practical advice, and has stated his own opinion as to the best method of dealing with the condition which is being considered. Every article is signed, even those which consist of a

few lines only. Throughout the book the articles are arranged in alphabetical fashion, but the advantage to be gained from this is distinctly lessened by the omnibus character of some of the monographs. For example, the treatment of diseases of children occupies forty consecutive pages, fevers fifty pages, heart conditions sixty pages, and so forth. A very good index is provided, and this enables the inquirer to get the information he wants with little trouble. The book is well written, its suggestions are helpful, and it should prove popular with those for whom it is intended.

X-rays and Radium in the Treatment of Diseases of the Skin. By G. M. Mackee, M.D. Pp. 602, with 272 illustrations. London: Henry Kimpton. 1922. Price 45s. net.

The first half of this volume is devoted to the physics, construction of apparatus, filtration of rays, and methods of measuring the dosage of X-rays and Radium. The effect of the rays on normal and pathological tissues is discussed, including radio-dermatitis and other dangers. The second half deals with each skin disease separately, every known disease, rare as well as common, being mentioned. The whole subject is most exhaustively treated and is explained with great lucidity. The author strongly favours the Coolidge X-ray tube as against the older gas tube. But the book owes its chief value to the fact that it is written by a dermatologist, who does not hesitate to state plainly the relative merits or demerits of radiation as against the ordinary local or internal methods of treatment. It will be valuable to the specialist by virtue of its completeness, and to the general practitioner, who wishes information as to whether radiation is likely to benefit a given skin disease. At the end is a useful chapter on medico-legal questions which may arise in connection with X-rays and Radium.

Intrinsic Cancer of the Larynx and the Operation of Laryngo-Fissure. By Irwin Moore. Pp. 147, with 46 illustrations. London: University of London Press. 1921.

The operation of laryngo-fissure or thyrotomy for the treatment of cancer of the vocal cords has become the recognised method of procedure mainly as the result of the teaching of the British school of laryngologists. In the hands of Durham, Butlin, and Semon in the past, and more recently through the teaching and practice of St Clair Thomson, its success has been established.

Cancer involving the interior of the larynx is, in the early stages, very slowly progressive and does not involve the lymph glands. Consequently, it is most favourably placed for successful surgical interference. Early diagnosis is essential, and upon this aspect of

the subject Irwin Moore lays due stress. After giving a historical account of the evolution of the operation, he dwells upon the clinical signs upon which the diagnosis should be made. He describes with minuteness of detail the preparation of the patient, the steps of the operation, and the after care of the case. The author is to be congratulated upon the excellent description of the operative technic as practised to-day, and his monograph ought to be in the hands of every laryngologist.

NEW EDITIONS

An Introduction to Dermatology. By NORMAN WALKER, LL.D., M.D., F.R.C.P. Seventh Edition. Pp. xviii + 366, with 164 illustrations. Edinburgh : W. Green & Son, Ltd. 1922. Price 21s. net.

A seventh edition of this well-known work on Diseases of the Skin has just been issued. In it the author has brought his subject thoroughly up to date, and has given to the profession the views he has formed from his long and ripe experience both in the treating of skin diseases and in the teaching of many generations of students in the Edinburgh School. The work is one of which both the author and the publishers may well be proud. Its chief characteristics are its scientifically simplified classification, its lucidity and terseness, its singular freedom from padding and unnecessary details, and the success with which the book has been illustrated not only in the numerous artistic and natural-looking plates but also in the figures in the text.

These characteristics will appeal not only to the undergraduate but also to the general practitioner on the outlook for the most successful and up-to-date method of diagnosis and treatment of any case he may have under his care.

Technique of the Teat and Capillary Glass Tube. By Sir A. E. WRIGHT and LEONARD COLEBROOK. Second Edition. Pp. xxvi + 384, with 154 illustrations. London : Constable & Company, Ltd. 1921. Price 42s. net.

The first edition of this book was produced in 1912. The second, much expanded, appears after an interval of nine years. Its avowed aim, in Sir Almroth Wright's own words, is "to bring it home to the general body of the medical profession that clinical experience—or shall we say observation?—unaided by apparatus and technique,

is for the purposes of research, of infinitely little account; and that advance in medicine will depend upon the application of some such apparatus and technique as is described here." Sir Almroth adds as an aside that this aim is "doubtlessly unrealisable." We agree. In the first place, the title of the book gives no indication that this is its aim; the "general body" of the medical profession will not understand that it is intended for their perusal. In the second, even a skilled laboratory worker may be excused if the study of this volume results in a depressing realisation of the amount of technique he has still to master; the "general body" would most certainly stand aghast at the prospect set before them. The effect would be deterrent. And in the third place, and this criticism we make with some hesitation, the complicated phraseology and the use of little understood words makes many sections of the book very difficult to understand. Among words and phrases used in the text for which it would be necessary to provide a glossary the following occur: "ecphylactic nidus," "serophytic and sero-saprophytic infection," "immunometric pus-impression culture," "antigeno-tropin," "subitaneous or aipsero-epiphylactic response," and so on. Such phrases do not illuminate. They obscure.

Let us now say that the technique described commands the highest admiration and respect. It has been evolved by Sir Almroth Wright and his fellow workers from his method, described in 1897, of making the necessary dilutions of serum in the Grünbaum (Widal) test. It has been called into service and developed in immunological experiments, in the study of red cells, of leucocytes; in the examination of the blood as to its alkalinity, its coagulability, its antitryptic power and so on; in the study of infected wounds; and in numerous other directions the mere naming of which would occupy too much space. This technique is described with painstaking detail. As a work of reference the book will be of great value to the worker in laboratory and side-room. He will not necessarily follow slavishly the methods described, but he can hardly fail to get from them a wealth of new ideas. The volume is well produced and beautifully illustrated.

Preventive Medicine and Hygiene. By Milton J. Rosenau, M.D Fourth Edition. Pp. 1567, with 194 illustrations. London: D. Appleton & Co. Price 45s. net.

Few books on preventive medicine have attained such a high rank as that of Dr Rosenau. Wherever his subject of Sanitation is studied this text-book can be ranked as a standby of authoritative information. In a short review it would be impossible to attempt to give Dr Rosenau's portly volume the justice it deserves. Our own Health Ministries would do well if they gave a close study to the chapter

dealing with Occupational Diseases and those relating to Industrial Hygiene. We are far behind our American cousins in the direction of Industrial Welfare. We are also behind in the efforts we make to deal with Diphtheria. The Schick test is only known as a term to most of our hygienists on this side. The chapter on the subject of infectious disease and *inter alia* on the problem of administrative control of Diphtheria by means of the Toxin-Antitoxin reaction is well worth study. But the well-printed text-book, clearly printed and excellently indexed, is replete with sanitary subjects that are treated in a most interesting and convincing manner. There is no better book on Preventive Medicine written in the English language.

NOTES ON BOOKS

Garrison's *History of Medicine* (W. B. Saunders Company, price 45s.), now in its third edition, is established as a standard work of reference. Despite his preoccupation with military and official duties since the previous revision was made, Col. Garrison has been able to incorporate in this new issue a summary of all the recent research on matters of ancient history as well as of the modern advances that have contributed to make medical history. Not the least valuable section of the work is the appendix "Bibliographical Notes for Collateral Reading," which furnishes the student with references to all the standard literature of the subject.

Mr C. W. Cathcart has provided a thoroughly sound guide on *Training, and how to keep always fit* (E. & S. Livingstone, price 2s. 6d.). It is based on scientific principles which have been tested personally, and the régime prescribed is simple and practicable.

In *A Primer for Diabetic Patients* (W. B. Saunders Company, 7s. 6d. net), Dr Wilder and Misses Foley and Ellithorpe, Dietitians in the Mayo Clinic, have produced a book which will be useful both to the doctor and his patient. It gives an outline of the modern method of treatment sufficient for the patient, and there are a number of useful recipes.

Under the title of *The Clinical Method in the Study of Disease* (Henry Frowde and Hodder & Stoughton, 5s. net) Dr R. M. Wilson has published a short biography and appreciation of the work of the late Dr Horace Dobell, who died at the ripe age of ninety, in 1917. Dr Dobell was a thoughtful and learned physician, and the memorial volume will be welcome to many of his old friends.

Botany for Students of Medicine and Pharmacy, by F. E. Fritch and E. J. Salisbury (G. Bell & Sons, Ltd., price 10s. 6d. net), is admirably

suited to meet the requirements of those to whom it is addressed. The authors have accurately gauged the scope of their subject in a medical curriculum.

Readers who are not diverted by the cheap flippancy of the introductory sentence will find Dr B. B. Grover's *Handbook of Electrotherapeutics* (Philadelphia, F. A. Davis Company, price $4) a simply expressed introduction to the use of electrical methods in the treatment of disease.

Medical Electricity for Students, by Miss A. R. I. Browne (Henry Frowde and Hodder & Stoughton, price 12s. 6d. net) is simply and clearly written, gives a general introduction to the subjects of Electricity and Magnetism, and details the applications of these to therapeutic practice.

NOTES

Sir Halliday Croom.

On the evening of 7th April Emeritus-Professor Sir Halliday Croom was entertained to a Complimentary Dinner by his former assistants, class-assistants, and residents, to mark the occasion of his retiral from the Chair of Midwifery in the University and the completion of fifty years of teaching in the Edinburgh School. An effort had been made to communicate with all his surviving assistants and residents, but owing to imperfect hospital records this was not possible. Some fifty, however, were reached, and subscribed towards the presentation of a silver salver with a suitable inscription and the autograph signatures of the donors engraved upon it. This was presented by the Chairman, Dr Haig Ferguson, as representing Sir Halliday's private assistants, while the toast of his health was supported by Dr George Mackie, D.S.O., as representing his old residents, and Dr George Gibson, D.S.O., as representing the former class-assistants. Sir Halliday Croom replied in a speech full of most interesting reminiscences of his career as a teacher of Midwifery and Gynæcology at Minto House and later at the University, delivered in his happiest vein. Amongst those present were Dr Godfrey (Scarborough), Dr Hale Puckle, Dr Scott Macgregor (Glasgow), Dr Duncan Main (Manchuria), Dr Donald (Carlisle), Dr Hearder (Ilkley), Dr Aarons and Dr Edward Burnet (London), Dr Lamond Lackie, Dr Wm. Fordyce, and Dr R. W. Johnstone (Edinburgh). Telegrams and letters of regret and apology were received from a number of old residents from such distant parts as Montreal, Egypt, and New Zealand.

Books Received

Appointments.

Dr Benjamin Philip Watson, at present Professor of Midwifery and Gynæcology in the University of Toronto, has been appointed to the Chair of Midwifery in the University of Edinburgh, *vice* Sir Halliday Croom, resigned.

Mr William Wright Smith, M.A., F.R.S.E., F.L.S., has been appointed to the Chair of Botany in the University of Edinburgh, *vice* Sir Isaac Bayley Balfour resigned.

Dr John Macpherson, C.B., has accepted the post of Professor of Psychiatry in the University of Sydney.

BOOKS RECEIVED

Bainbridge, W. S., Traduit de l'Anglais par le Dr Hertoghe. Le Problème du Cancer . . . . . (*Uystpruyst, Louvain : Doin, Paris*)

Black, Norman. Local Anæsthesia in Dental Surgery. Second Edition . . . . . (*John Bale, Sons, & Danielsson, Ltd.*) 5s.

Bulkley, L. Duncan. Cancer and its Non-Surgical Treatment (*Wm. Wood & Co., New York*) $6.00

Comby, Jules. Alimentation Hygiène des Enfants. 4me Edition (*Vigot Frères, Paris*)

Darroch, John. Chinese Grammar Self-Taught (*Marlborough & Co.*) 6s ; cloth, 7s. 6d.

Elliot, R. H. A Treatise on Glaucoma. Second Edition (*Oxford Medical Publications*) 30s.

Episcopal Hospital Reports, Philadelphia. Vol. V., 1917-20 (*Wm. J. Dornan*)

International Clinics. Vol. I., 1922 (*J. B. Lippincott Company*) 42s. per four vols.

Keynes, Geoffrey. Blood Transfusion (*Oxford Medical Publications*) 8s. 6d.

Little, E. Muirhead. Artificial Limbs and Amputation Stumps (*H. K. Lewis & Co., Ltd.*) 18s.

Ortner, Norbert. Abdominal Pain (*Rebman Company, New York*) $5.00

Peterson, William F. Protein Therapy and Non-Specific Resistance (*The Macmillan Company*) 21s.

Post-Graduate Lectures. 1919-20 (*John Bale, Sons, & Danielsson, Ltd.*) 10s. 6d.

Reports of the St Andrews Institute for Clinical Research. Vol. I. (*Oxford Medical Publications*) 10s. 6d.

Transactions of the College of Physicians in Philadelphia. Vol. XLII. 1920

Webster, Alfred. Cardiac Arrhythmia and the Neocardiology (*Watts & Co.*) 25s.

Zinsser, Hans. A Textbook of Bacteriology. Fifth Edition (*D. Appleton & Co.*) 35s.

INDEX

NOTE.—Entries with *Chir.* and *Obst.* refer to Medico-Chirurgical and Obstetrical Societies' Transactions respectively.

AMPUTATIONS, Demonstration of Artificial Limbs for (C. W. Cathcart), *Chir.*, 73
Anæsthesia, Spinal, Observations on (D. N. Kalyanvala), 267
Anæsthetists, Scottish Society of, 97
Analytical Notes, 95
Aneurysm, Gluteal, *Chir.*, 28
—— Traumatic, *Chir.*, 33
Angeioma, Pulsatile, *Chir.*, 28
Appendix Epiploica, Torsion of, simulating Acute Appendicitis (J. N. J. Hartley), 111
Appointments, 97
Artificial Limbs for Amputations, Demonstration of (C. W. Cathcart), *Chir.*, 73
Asthma: Its Pathology and Treatment (J. J. Graham Brown), 54

BALLANTYNE, J. W., Cæsarean Section: Its Indications and Technique, 28, 74
Basal Metabolic Rate (J. Meakins and W. W. Davies), 4
Books Received, 48, 96, 152, 184, 232
Boyd, Francis D., *see* Obituaries
Brown, J. J. Graham, A Note on Asthma: Its Pathology and Treatment, 54

CÆSAREAN Section (J. W. Ballantyne), 28, 74
—— and Alternative Treatment (J. L. Lackie), *Obst.*, 61
—— in Multiple Pregnancy (W. Fordyce), *Obst.*, 41
Caird, Francis M., Internal Strangulation of the Small Intestine caused by Bands, Adhesions, and Kinks, *Chir.*, 78
Caird, Francis M., Valedictory Address, Medico-Chirurgical Society, *Chir.*, 1
Cathcart, C. W., Artificial Limbs for Amputations, *Chir.*, 73
Cerebral Abscess, *Chir.*, 29
Clinical Meeting, Special, *Chir.*, 21

Clinical Records—
A Case of Meningeal Nævus (D. M. Greig), 105
Torsion of Appendix Epiploica simulating Acute Appendicitis (J. N. J. Hartley), 111
Complement-Fixation Reaction in Tuberculosis (A. Nimmo Smith), 174, 212
Comrie, J. D., Diagnosis and Prognosis in Kidney Cases by Tests for Renal Function, *Chir.*, 34, 45
Craig, Wm., *see* Obituaries

Critical Reviews—
Cæsarean Section (J. W. Ballantyne), 28, 74
Complement-Fixation Reaction in Tuberculosis (A. Nimmo Smith), 174, 212
Recent Conceptions of Stomach Physiology and the Genesis of Gastric Pain (R. Mailer), 114
Venereal Diseases, Controversy regarding Prevention of (W. Robertson), 123
Croupous Pneumonia, Prognosis of, in Older Patients (R. A. Fleming), *Chir.*, 69
Culture Medium for Intestinal Flora (Chalmers Watson), *Chir.*, 21

Index

DAVIDSON, HUGH S., A Case of Ovarian Dermoid Rupturing into the Bowel during Labour, *Obst.*, 54

Davies, W. Whitridge, and Jonathan Meakins, Basal Metabolic Rate: Its Determination and Clinical Significance, 4

Dermoid, Ovarian, Rupturing into the Bowel during Labour, A Case of (H. S. Davidson), *Obst.*, 54

Diabeticorum, Xanthoma, with Report of a Case (D. Murray Lyon), 168

Duodenal Ileus, Chronic, *Chir.*, 30

Duodenal Ulcer, Perforated, *Chir.*, 33

EDITORIAL Notes, 1, 49, 97

Endocarditis, Chronic Rheumatic, *Chir.*, 24

Enlargement, Simple, of the Prostrate (Sir D. Wallace), *Chir.*, 10

FERGUSON, JAMES HAIG, Inversion of the Uterus, with a Record of Four Cases, *Obst.*, 33

Fibroma of the Ovary, Demonstration of (H. S. Davidson), *Obst.*, 58

Fleming, Robert A., The Prognosis of Croupous Pneumonia in the Older Patient, with a Suggestion as to a Radical Modification of the Usual Plan of Treatment, *Chir.*, 69

Fœtal Ovary, Demonstration of (F. J. Browne), *Obst.*, 58

Fordyce, Wm., A Case of Cæsarean Section in Multiple Pregnancy, *Obst.*, 41

—— Valedictory Address, Edinburgh Obstetrical Society, *Obst.*, 1

Friedreich's Ataxia, *Chir.*, 22

GASTRIC Pain, Recent Conceptions of Stomach Physiology and the Genesis of (R. Mailer), 114

Glycosuria, The Significance and Treatment of (H. Rainy), *Chir.*, 46

Gonorrhœal Rheumatism, with Details of a New Method of Treatment (A. O. Ross), 185

Greig, David M., A Case of Meningeal Nævus, 105

—— Oxycephalic Skull, Demonstration of, *Chir.*, 45

—— Myiasis Œstrosa, 258

—— On Puberal Mammary Hypertrophy, 153

Gynæcological Diagnosis, Pneumoperitoneum of the Pelvis as an Aid to (R. L. Impey), *Obst.*, 21

Gynæcology and Obstetrics, Some Unsolved Physiological Problems in (R. W. Johnstone), 198

HARTLEY, J. N. J., Torsion of Appendix Epiploica simulating Acute Appendicitis, 111

Heart Affections, Three Cases of Congenital, *Chir.*, 26

Hypertrophy, Puberal Mammary (D. M. Greig), 153

IMPEY, R. LANCE, Pneumo-peritoneum of the Pelvis as an Aid to Gynæcological Diagnosis, *Obst.*, 21

Infantilism associated with Diarrhœa, *Chir.*, 23

Intestine, Internal Strangulation of Small, by Bands, Adhesions, and Kinks (F. M. Caird), *Chir.*, 78

Intussusception, Atypical Cases, *Chir.*, 31

Inversion of the Uterus (J. Haig Ferguson), *Obst.*, 33

JOHNSTONE, R. W., Some Unsolved Physiological Problems in Gynæcology and Obstetrics, 198

KALYANVALA, D. N., Observations on Spinal Anæsthesia, 267

Keratodermia Blenorrhagica (D. Lees), 99

Kidney Cases, Diagnosis and Prognosis in, by Tests for Renal Function (J. D. Comrie), *Chir.*, 34, 45

Kidney, Granular Contracted, *Chir.*, 25

Kirk, The late Sir John, 98

Index

Labour, A Case of Ovarian Dermoid Rupturing into the Bowel during (H. S. Davidson), *Obst.*, 54
—— Induction of Premature (H. O. Nicholson), *Obst.*, 73
Lackie, J. Lamond, Cæsarean Section and Alternative Treatment, *Obst.*, 61
Lees, David, Keratodermia Blenorrhagica, 99
Letter from Vienna, 41
Leukæmia, Further Observations into the Etiology of Malignant Disease and (J. Young), 233
Lyon, D. Murray, Xanthoma Diabeticorum, with Report of a Case, 168

Mailer, Robert, Recent Conceptions of Stomach Physiology and the Genesis of Gastric Pain, 114
Malignant Disease and Leukæmia, Further Observations into the Etiology of (J. Young), 233
Mammary Hypertrophy, Puberal (D. M. Greig), 153
Meakins, Jonathan, and W. Whitridge Davies, Basal Metabolic Rate: Its Determination and Clinical Significance, 4
Medico-Chirurgical Society of Edinburgh, Transactions of the, *Chir.*, 1, 21
Meningeal Nævus, A Case of (D. M. Greig), 105
Mesenteric Cyst, *Chir.*, 31
Metabolic Rate, Basal (J. Meakins and W. W. Davies), 4
Mills, Arthur, The Wassermann Test in General Practice, 19
Multiple Pregnancy, Cæsarean Section in (W. Fordyce), *Obst.*, 41
Myiasis Œstrosa (D. M. Greig), 258

Nævus, Meningeal, A Case of (D. M. Greig), 105
Nasal Reconstruction, *Chir.*, 30
Neck, Lympho-sarcoma of, *Chir.*, 21
Nicholson, H. O., Induction of Premature Labour, *Obst.*, 73

Obituaries—
Boyd, Francis D., 274
Craig, William, 179, and *Obst.*, 59
Kirk, Sir John, 98
Paterson, William, 1
Sanders, W. G. W., 86
Woodhead, Sir G. S., 152
Obstetrical Society, Transactions of the Edinburgh (*Obst.*), 1, 21, 33
Obstetrics, Some Unsolved Physiological Problems in Gynæcology and (R. W. Johnstone), 198
Ovarian Dermoid Rupturing into the Bowel during Labour, A Case of (H. S. Davidson), *Obst.*, 54
Ovary, Fibroma of the, Demonstration of (H. S. Davidson), *Obst.*, 58
Ovary, Fœtal, Demonstration of (F. J. Browne), *Obst.*, 58
Oxycephalic Skull, Demonstration of (D. M. Greig), *Chir.*, 45

Paralysis of left facial nerve and of right upper arm, *Chir.*, 24
Passes, 52, 98
Paterson, William, *see* Obituaries
Pelvis, Pneumoperitoneum of the, as an Aid to Gynæcological Diagnosis (R. L. Impey), *Obst.*, 21
Peritonitis, Acute Tubal, Diagnosis and Treatment of (J. W. Struthers), *Obst.*, 45
Physiological Problems, Unsolved, in Gynæcology and Obstetrics (R. W. Johnstone), 198
Pneumonia, Croupous, Prognosis of in Older Patient (R. A. Fleming), *Chir.*, 69
Pneumoperitoneum of the Pelvis as an Aid to Gynæcological Diagnosis (R. L. Impey), *Obst.*, 21
Polypus, Fibrous, of the base of the Skull, *Chir.*, 29
Post-Graduate Instruction, 3, 53
Pregnancy, Multiple, Cæsarean Section in (W. Fordyce), *Obst.*, 41
Prevention of Venereal Diseases, Controversy regarding (W. Robertson), 123
Professional Examinations, 49

Prostate, Simple Enlargement of the (Sir D. Wallace), *Chir.*, 10
Prostatectomy, *Chir.*, 27
Puberal Mammary Hypertrophy (D. M. Greig), 153

RAINY, HARRY, The Significance and Treatment of Glycosuria, *Chir.*, 46
Renal Function, Diagnosis and Prognosis in Kidney Cases by Tests for (J. D. Comrie), *Chir.*, 34, 45
REVIEWS—
Aaron, Charles G., *Diseases of the Digestive Organs*, 228
Abrahams, A., and A. Clifford Morston, *A Guide to Urinary Diseases*, 231
Annals of Medical History, vol. iii., 94
Arvredson, J., *Notes on Disease treated by Medical Gymnastics and Massage*, 149
Beattie, J. M., and W. E. Carnegie Dickson, *A Text-book of Special Pathology*, 143
Bennett, Reginald R., *Materia Medica and Pharmacy*, 150
Binnie's *Manual of Operative Surgery*, 46
Black, Norman, *Local Anæsthesia in Dental Surgery*, 47
Bourne, Aleck W., *Synopsis of Midwifery*, 230
Browne, A. R. I., *Medical Electricity*, 283
Browne, Edward G., *Arabian Medicine*, 94
Bruce, Mitchell, and W. J. Dilling, *Materia Medica and Therapeutics*, 46
Byam, W., and R. G. Archibald, edited by, *The Practice of Medicine in the Tropics*, 277
Cathcart, C. W., *Training; and How to Keep Always Fit*, 282
Chavasse's *Advice to a Wife*, 94
Cheatle, A. H., *Lantern Slides illustrating the Anatomy of the Temporal Bone*, 149
Reviews—*continued*
Coles, Alfred C., *Critical Microscopy*, 146
Cope, Zachary, *The Early Diagnosis of the Acute Abdomen*, 47
Crile, George W., *A Physical Interpretation of Shock, Exhaustion, and Restoration*, 45
Crowther, J. A., *A Manual of Physics*, 145
Cumston, C. G.. and Georges Patry, *The Surgical Treatment of Non-Malignant Affections of the Stomach*, 226
Cushman, Allerton S., *Chemistry and Civilisation*, 94
Das, Kedaenath, *A Text-book of Midwifery*, 147
Daukes, S. H., *Barrier Charts for Health Officers*, 149
Davis, Edward P., *Mother and Child*, 149
Dictionary of Practical Medicine, 181
Dobell, Clifford, and F. W. O'Connor, *The Intestinal Protozoa of Man*, 138
Ernst, F. G., *Orthopædic Apparatus*, 231
Fairbairn, John S., *Encyclopædia of Midwifery and the Diseases of Women*, 181
—— *Text-book for Midwives*, 231
Fehlinger, H., *Sexual Life of Primitive People*, 147
Finkelnburg, Rudolf, *Die Therapie an den Bonner Universitäts-kliniken*, 93
Fitzwilliams, D. C. L., *A Pocket Surgery*, 138
Fowler, Sir James Kingston, *Pulmonary Tuberculosis*, 91
Fritch, F. E., and E. J. Salisbury, *Botany for Students of Medicine and Pharmacy*, 282
Gammons, Herbert F., *Practical Tuberculosis*, 150
Garrison, Fielding H., *An Introduction to the History of Medicine*, 282

Index

Reviews—*continued*

Gordon, Alfred, *French-English Medical Dictionary*, 94

Grover, B. B., *Handbook of Electrotherapy*, 283

Guthrie, Douglas, *Diseases of the Ear, Nose, and Throat in Childhood*, 149

Halstead, W. S., *Ligation of the Left Subclavian in its First Part*, 136

Harrison, L. W., *The Diagnosis and Treatment of Venereal Diseases in General Practice*, 227

Herbert, A. S., *Hot Springs of New Zealand*, 151

Holt, Emmet, *Care and Feeding of Children*, 148

Horsley, J. Shelton, *Operative Surgery*, 183

International Journal of Gastro-enterology, 152

Journal of the Philippine Islands Medical Association, 152

Kerr, J. Graham, *Zoology for Medical Students*, 137

King, D. Barty, *Studies in Influenza and its Pulmonary Complications*, 230

Kirkpatrick, Henry, *Cataract and its Treatment*, 232

Labbe, Marcel, *Le Diabète Sucré*, 227

Lane-Claypon, Janet E., *Hygiene of Women and Children*, 231

Langley, J. N., *The Autonomic Nervous System*, 223

Lépine, R., *Le Sucre du Sang*, 226

Lyle, H. W., and David de Souza, *Manual of Physiology*, 230

Macarthur, John, *Mental Hospital Manual*, 148

MacKee, G. M., *X-Rays and Radium in the Treatment of Diseases of the Skin*, 279

Mackenzie, Sir James, *Heart Disease and Pregnancy*, 135

—— *Symptoms and their Interpretation*, 46

Reviews—*continued*

Maclean, Hugh, *Modern Methods in the Diagnosis and Treatment of Renal Disease*, 224

Menzies, K., *Autoerotic Phenomena in Adolescence*, 94

Milroy, J. A., and T. H. Milroy, *Practical Physiological Chemistry*, 229

Monrad-Krohn, G. H., *Clinical Examination of the Nervous System*, 150

Moore, Irwin, *Intrinsic Cancer of the Larynx*, 279

Moorhead, John J., *Traumatic Surgery*, 144

Murrell's *What to do in Cases of Poisoning*, 94

Nicolle, M., *Les Antigènes et les Anticorps*, 93

Oertel, Horst, *General Pathology*, 44

Osborne, Oliver T., *Principles of Therapeutics*, 90

Parfitt, J. B., *Operative Dental Surgery*, 151

Reaberger, G. E., *Lippincott's Quick Reference Book, Medicine and Surgery*, 148

Roberts, John D., and James A. Kelly, *Treatise on Fractures*, 143

Robertson, W., and Charles Porter, *Sanitary Law and Practice*, 142

Roger, Widal, and Teissier, *Nouveau Traité de Médecine*, Fasc. III. and Fasc. VII., 139

Rogers, Sir Leonard, *Bowel Diseases in the Tropics*, 278

Rose, W. D., *Physical Diagnosis*, 147

Rudolf, R. D., *Notes on the Medical Treatment of Disease*, 44

Russell, William, *The Stomach and Abdomen*, 92

Schweinitz, G. E. de, *Diseases of the Eye*, 232

Sheffield, Herman B., *Diseases of Children*, 150

Slemons, J. Morris, *The Prospective Mother*, 146

Index

Reviews—*continued*
Sorapure, Victor E., Edited by *The Oxford Index of Therapeutics*, 278
Stelwagon, H. W., and H. K. Gaskell, *A Treatise on Diseases of the Skin*, 229
Stengel, Alfred, and Herbert Fox, *Text-book of Pathology*, 46
Stoddart, W. H. B., *Mind and its Disorders*, 228
Talbot, Eugene S., *Developmental Pathology*, 136
Taylor, W. W., *The Chemistry of Colloids and some Technical Applications*, 141
Thomson, Alexis, and Alexander Miles, *Manual of Surgery*, 141
Thomson, H. Campbell, *Diseases of the Nervous System*, 145
Thomson, H. Hyslop, *Tuberculosis: Its Prevention and Home Treatment*, 150
Tousey, Sinclair, *Medical Electricity, Röntgen Rays and Radium*, 145
Transactions of the American Association of Genito-Urinary Surgeons, 1920, 152
Transactions of the American Urological Association, 151
Transactions of the College of Physicians of Philadelphia, 152
Variot, Gaston, *Traité Pratique des Maladies des Enfants du Premier Age*, 93
Walters, F. R., *Domiciliary Treatment of Tuberculosis*, 231
Whitnall, S. Ernest, *The Anatomy of the Human Orbit and Accessory Organs of Vision*, 47
Whittaker, J. Ryland, *Anatomy of the Brain and Spinal Cord*, 148
Wilde, Percy, *The Physiology of Gout, Rheumatism, and Arthritis*, 230
Wilder, R. M., and Others, *A Primer for Diabetic Patients*, 282
Wilson, R. M., *Clinical Method in the Study of Disease*, 282
Reviews—*continued*
Wilson, R. M., *The Clinical Study of the Early Symptoms and Treatment of Circulatory Disease in General Practice*, 224
Wood, Sir Kingsley, *Dental Registration*, 151
Woodhead, Sir G. S., and P. C. Varrier Jones, *Industrial Colonies and Village Settlements for the Consumptive*, 222
Young, James, *A Text-book of Gynæcology*, 225
Rheumatism, Gonorrhœal, with Details of a New Method of Treatment (A. O. Ross), 185
Robertson, Wm., The Controversy Regarding the Prevention of Venereal Diseases, 123
Ross, A. O., Gonorrhœal Rheumatism, with Details of a New Method of Treatment, 185
Round-celled Sarcoma of the Uterus, Demonstration of (J. Young), *Obst.*, 59
Royal College of Physicians, 2
—— of Surgeons, 53

SANDERS, W. G. W., *see* Obituaries
Sarcoma, Round-celled, of the Uterus (J. Young), *Obst.*, 59
Scleroderma, *Chir.*, 25
Scottish Society of Anæsthetists, 97
Simple Enlargement of the Prostate (Sir D. Wallace), *Chir.*, 10
Skin-graft, whole-thickness, *Chir.*, 32
Skull, Oxycephalic, Demonstration of (D. M. Greig), *Chir.*, 45
Smith, A. Nimmo, The Complement-Fixation Reaction in Tuberculosis, 174, 212
Spinal Anæsthesia, Observations on (D. N. Kalyanvala), 267
Splenic Anæmia, *Chir.*, 22
Stomach Physiology and the Genesis of Gastric Pain, Recent Conceptions of (R. Mailer), 114

Index

Strangulation, Internal, of the Small Intestine by Bands, Adhesions, and Kinks (F. M. Caird), *Chir.*, 78
Struthers, J. W., The Diagnosis and Treatment of Acute Tubal Peritonitis, *Obst.*, 45
Student's Expenditure, 98
Stunted Growth of Left Forearm and Hand, *Chir.*, 32

TORSION of Appendix Epiploica simulating Acute Appendicitis (J. N. J. Hartley), 111
Transactions of the Medico-Chirurgical Society of Edinburgh, *Chir.*, 1, 21
—— of the Edinburgh Obstetrical Society, *Obst.*, 1, 21, 33
Triple Qualification Passes, 98
Tubal Peritonitis, Acute, Diagnosis and Treatment of (J. W. Struthers), *Obst.*, 45
Tuberculosis, Complement-Fixation Reaction in (A. Nimmo Smith), 174, 212

URETERS, Transplantation of, into Pelvic Colon, *Chir.*, 28
Uterus, Inversion of (J. Haig Ferguson), *Obst.*, 33
—— Round-celled Sarcoma of the (J. Young), *Obst.*, 59

VALEDICTORY Address, Medico-Chirurgical Society, *Chir.*, 1
—— Edinburgh Obstetrical Society, *Obst.*, 1
Venereal Diseases, The Controversy regarding the Prevention of (W. Robertson), 123
Vienna Letter, 41

WALLACE, Sir DAVID, Simple Enlargement of the Prostate, *Chir.*, 10
Wassermann Test in General Practice (A. Mills), 19
Woodhead, Sir G. Sims, *see* Obituaries

XANTHOMA Diabeticorum, with Report of a Case (D. Murray Lyon), 168

YOUNG, JAMES, Further Observations into the Etiology of Malignant Disease and Leukæmia, 233

PRINTED BY
OLIVER AND BOYD
EDINBURGH

Edinburgh Medical Journal

Med
E.

Edinburgh Medical Journal

With which is Incorporated the
Scottish Medical and Surgical Journal

EDITED BY

ALEXANDER MILES AND J. S. FOWLER

July to December 1922

(NEW SERIES)—VOLUME XXIX

[Ser. 3]

Edinburgh

Published for the Proprietors by

Oliver and Boyd, Tweeddale Court

London: 33 Paternoster Row

1922

Edinburgh Medical Journal

July 1922

ON THE SIGNIFICANCE OF PYURIA IN CHILDREN.*

By J. S. FOWLER.

THE occurrence of pus in the urine is not an uncommon event in childhood. To give an idea of the frequency with which pyuria is met with in hospital practice as compared with other diseases, the statement may be made that it is less common by about one-fourth than the group of rheumatic infections. The remarks which follow are based on notes of seventy-six cases seen for the most part in hospital practice during the past fifteen years. My reason for choosing the subject as a suitable topic for an address of this nature is a two-fold one. First, the more extended use of cystoscopy and radiography in recent years has thrown a great deal of light on the condition and has correspondingly improved diagnosis and treatment. Second, from the point of view of the general practitioner, these cases are troublesome in that for their complete elucidation various expert examinations—bacteriological, radiographic, and surgical —are often required. It is simple enough to arrange for these in a hospital, but in private practice there are some drawbacks, and it has to be remembered that the majority of cases recover completely under medical treatment alone. It has therefore seemed desirable to analyse this series of cases with the object of discovering how far the clinical findings in conjunction with the bacteriology afford guidance in deciding whether a case should be at once referred to a surgeon for further investigation, or whether there is a reasonable probability of its being curable by medical treatment alone. In this connection the great importance of detecting tuberculosis of the kidney at the earliest possible moment has to be borne in mind.

* An Address delivered to the Fifeshire Branch of the British Medical Association on 30th March 1922.

The Age and Sex Distribution of the cases is shown in Table I., from which it is apparent that the disease occurs throughout the whole of childhood. The table also illustrates two well-known facts: first, that pyuria is much more common in girls than in boys; second, that acute cases occur most frequently in infancy. What is perhaps less generally realised is that when the condition does occur in a boy the chance of its being of a serious nature is much greater than if the patient be a girl. Cases occurring in males, therefore, always demand the most thorough investigation from the outset, as the prospect of their requiring surgical treatment is considerable.

TABLE I.

	Age in Years.													
	1	2	3	4	5	6	7	8	9	10	11	12		
Females—														
Acute . .	3	6	2	3	1	1	2	2	...	...	...	1	=21	65
Chronic . .	1	5	3	3	1	6	6	4	3	5	4	3	=44	
Males—														
Acute . .	2	1	...	...	...	...	...	...	...	...	...	...	=3	11
Chronic . .	...	...	1	...	2	1	2	1	...	...	...	1	=8	
	6	12	6	6	4	8	10	7	3	5	4	5		76

Bacteriology.—The next point to be discussed is the bacteriology of the urine in these cases. It is perhaps worth while mentioning that as regards girls, while no special precautions are required in obtaining a specimen for microscopic examination in the ordinary acute case, a catheter specimen is essential in any doubtful case, and in all chronic forms of the disease. In boys a satisfactory specimen can usually be obtained without catheterisation, by cleansing the meatus and rejecting the first portion of urine passed.

Table II. gives the findings in two series of urinary examinations, from Great Ormond Street and the Edinburgh Sick Children's Hospital respectively, and it will be noted that as might be expected the coliform group of organisms predominate. The figures, however, are merely bacteriological findings, and are apt to mislead. In fact, of the three principal methods of examination—bacteriological, X-ray, and cystoscopic—the first named is on the whole the least valuable and may be an untrustworthy guide. In Table III. the various diseases

TABLE II.

	Total.	*B. coli.*	*B. coli* and Pyogenic.	*B. coli* and other Organisms.	Friedlander.	*B. œrogenes* Caps.	*B. typhosus.*	*B. enteritidis.*	*B. proteus.*	Staphylococci.	Streptococci.
London . .	88	56	10	...	...	...	...	2	5	12	3
Edinburgh . .	49	26	10	2	1	1	1	...	...	5	3
	137	82	20	2	1	1	1	2	5	17	6
		109 = 80 per cent.							28 = 20 per cent.		

met with in this series of cases have been classified along with the bacteriological findings, and it will be seen that, whatever the disease, the *B. coli* and its allies are the most common organisms. The infrequency with which the tubercle bacillus was detected, in spite of careful and repeated search, is also noteworthy. So far as the diagnosis of the cause of chronic pyuria is concerned, even repeated pure culture of *B. coli* alone from the urine is no proof whatever that we are dealing with a coli infection only, and not with stone or tubercle. In fact the absence of the *B. coli* is of more diagnostic value than its presence, at least in chronic cases.

TABLE III.

	B. coli.	*B. coli.* and Pyogenic.	Friedlander.	Staphylococci.	*B. proteus.*	*B. tuberculosis.*	Sterile.	Not Stated.	
Acute Pyelitis . . .	16	...	...	1	1	...	...	...	18
Chronic Pyelitis and Cystitis.	29	3	1	2	...	...	...	...	35
Tuberculosis	2	...	...	2	...	2	1	...	7
Probable Tuberculosis . .	1	1	...	...	...	...	1	...	3
Calculus	2	1	...	1	1	...	1	1	7
Pyonephrosis. . . .	4	1	...	...	...	...	...	1	6
	54	6	1	6	2	2	3	2	76

Clinical Aspects of Pyuria.

Acute Pyelitis may first be shortly referred to. As Table IV. shows, typical acute pyelitis is almost limited to little girls. Thanks in particular to the writings of Dr John

Thomson, the classical symptoms of acute pyelitis in infancy are now well known—the sudden onset with fever and often rigors, and the rapid response to treatment with alkalis: it is not necessary to dwell on these cases in detail. Three practical points, however, may be mentioned:—(1) *Rigors.* These, a striking feature when they occur, are not infrequently absent, especially in children over a year. As Thomson points out, they often differ a good deal from the rigor of the adult, and partake more of the nature of a brief, convulsive shudder, repeated at short intervals. (2) *Examination of the Urine.* When the specimen of urine is obtained it is important to examine it at once, because on standing it quickly loses the strongly acid reaction which, in association with the presence of motile bacilli, is characteristic. Early in the disease very few pus cells indeed may be present, and it is the finding of many bacilli in a freshly passed specimen of acid urine which is pathognomonic. If the specimen has been kept till it has lost its acid reaction no inference can be drawn from the presence of bacilli, as these may be associated with the alkaline fermentation. After the disease has lasted for a few days the pus cells become abundant, and there is then less difficulty. (3) *Effect of Alkalis.* While young infants respond very rapidly and strikingly to alkalis, these are less satisfactory in older children, and very large doses may be needed. In one of my cases 540 grains of potassium citrate daily were required to make the urine alkaline. The alkaline treatment is only successful in acute coli infections; in the much less common infections with *B. proteus* it is useless, though they readily yield to hexamine.

Acute Pyelo-nephritis.—The second type of acute infection, in which abscess formation takes place in the kidney substance, is a very much more serious matter, and appears to be invariably fatal. Of the 6 cases in the series, 3 occurred in boys, and 3 in girls, so that it is relatively common in boys. Both organs are involved in nearly all cases (5 out of 6 in this series), and the abscesses are numerous, small, and scattered throughout the kidney substance. Owing to the rarity of unilateral infection the question of operation scarcely arises. Moreover, children with pyelo-nephritis are always in such poor condition, and so prostrate, as to contra-indicate operation. The organism found in these cases is the *B. coli*, and the infection is either ascending, or by the blood stream.

Diagnosis.—How can we distinguish these severe infections from benign, acute pyelitis? (1) By the greater prostration which results. In pyelitis the child is distressed, fretful, and ill, but not exhausted, poisoned, and collapsed, as in pyelo-nephritis. The child with abscesses looks as if it were going to die; the child with pyelitis does not. (2) Treatment with alkalis does not do the slightest good; the urine becomes alkaline, but the patient is no better. (3) Not infrequently the kidneys can be felt to be enlarged, which is rare in pyelitis. (4) The patient is often a boy. (5) Rigors may occur in either pyelitis or pyelo-nephritis, but are more suggestive of the former. By attention to these points, especially to the cachexia and the failure of treatment, it is seldom difficult to distinguish the two diseases from one another.

Chronic Pyuria.—Tables IV. and V. illustrate some of the

TABLE IV.

	Females.	Males.	Deaths.
Acute pyelitis . . .	18	...	...
Chronic pyelitis . . .	32	2	1
Tuberculosis	5	2	...
Probable tuberculosis . .	3	1	...
Calculus	4	3	2
Abscesses	3	3	6
	65	11	9

TABLE V.

	Cured.	Improved.	Not Improved.	Died.
Males	4	1	2	4
Females—				
Acute . . .	16	2	...	3
Chronic . . .	22	17	3	2
Total . .	42	20	5	9

features of the condition. The preponderance of the more serious types in boys is well brought out.

Renal Tuberculosis.—In all cases of chronic pyuria the question of tuberculosis of the kidney should never be lost sight of, and no effort should be spared to settle it one way

or another. In children it is usually a local condition affecting only one kidney, and the results of removal are highly satisfactory. It is therefore essential to make a diagnosis as early as possible, and for this reason the details of the cases in this series are worth summarising.

In two the diagnosis was made by finding the bacillus in the urine. In each case the kidney was removed, and the patients were alive and well two and three years later. In one case only the colon bacillus could be found in the urine, but inoculation of a guinea-pig gave a positive result; the kidney was removed and the patient was quite well and had gained 5½ lb. in weight six months later. In three cases, with *B. coli*, *S. aureus*, and sterile urine respectively, the diagnosis was only a probable one, confirmed at operation. In all three the cystoscope showed pus coming from one ureter only, but in two of them both kidneys were found affected. One of these patients improved greatly under tuberculin. The third patient had one kidney removed, and did well. The seventh case was not operated on as there was evidence of generalised tuberculosis of the genito-urinary tract.

Grave and Benign Pyuria.—An attempt has been made, by analysis of the symptoms presented by these cases, to arrive at some conclusion as to the possibility, by clinical and bacteriological examination alone, of dividing them into those favourable, or benign, cases in which one may justifiably give medical treatment a fair trial in the first instance, and into grave cases in which the probability of there being something more than a simple bacterial infection is so great as to forbid delay in having a cystoscopic and radiographic examination. In other words, what cases can the physician deal with himself, and which should he send to a surgeon? The great difficulty as regards the purely clinical examination is the comparative dearth of physical signs. From the practical standpoint, little or nothing is gained by attempting to distinguish between cases of cystitis and cases of infection higher up, because what we have found since cystoscopy has been done as a routine in all cases is that with pus oozing from one or both ureters a secondary cystitis, often with ulceration, is present. Consequently, complaints of painful micturition, frequency, enuresis, etc., may be met with in any type of case, and afford no useful indication in the direction sought. The complaint of pain in one or other loin may be relied on to show that the correspond-

ing kidney is involved, but it is met with in so many cases that do perfectly well on complete rest and urotropine, as to be no guide. Occasionally, in addition to pus cells, a few granular or hyaline casts may be seen in the urine; they were found in two of the cases of calculus, but, apart from this, they do not appear to have much significance.

From a study of this series of cases it would appear that the facts on which a diagnosis between the grave and benign types of pyuria can be made are seven in number, and are as follows:—(1) Male sex. (2) A large quantity of pus. (3) Blood in the urine. (4) Palpable enlargement of the kidney. (5) Definite continued tenderness in the loin. (6) The presence in the urine of organisms other than the coli group. (7) The existence of cachexia.

The only one of these which requires definition is the second. In simple coli infections the amount of pus is usually

TABLE VI.

	Male Sex.	Pus in Excess.	Blood.	Kidney Palpable.	Loin Tender.	Organisms other than *B. coli*.	Cachexia.	
1. Tuberculosis		+		+	+	+		Cured
2. Probable tuberculosis	+	+	+		+	+		Improved
3. Tuberculosis		+		+	+	+		Cured
4. „		+		+	+	+		„
5. Cystitis	+		+			+		„
6. Calculus	+	+	+			+		Died
7. Tuberculosis	+	+	+					I. S. Q.
8. Calculus	+	+				+		Cured
9. Abscess	+	+					+	Died
10. Probable tuberculosis		+	+			+		Improved
11. Tuberculosis	+			+		+		Worse
12. Abscess	+			+		+	+	Died
13. Chronic pyelitis	+		+		+			Cured
14. „ „		+	+					Improved
15. Tuberculosis		+	+					Cured
16. Calculus		+		+				Died
17. Chronic pyelitis		+		+				Improved
18. „ „		+		+				„
19. Cystitis			+					Cured
20. Abscess				+		+	+	Died
21. „				+			+	„
22. Probable tuberculosis				+		+	+	Improved
23. Calculus			+			+		Cured
24. „	+	+						„
25. Tuberculosis		+				+		I. S. Q.
26. Abscess	+						+	Died
27. „		+					+	„

small—enough to form a thin layer at the bottom of the specimen glass. A layer of pus one-eighth of an inch deep or more may be looked on as "pus in excess."

Tables VI. and VII. illustrate the findings in the 76 cases; they may be divided roughly into two groups:—(1) 27 cases, or one-third of the total, in which *two or more* of

TABLE VII.

		Male Sex.	Pus in Excess.	Blood.	Kidney Palpable.	Loin Tender.	Organisms other than *B. coli.*	Cachexia.	
28.	Chronic pyelitis		+						Cured
29.	" "		+						Died
30.	" "		+						Cured
31.	Cystitis		+						"
32.	Chronic pyelitis			+					"
33.	Cystitis			+					"
34.	"			+					Improved
35.	Chronic pyelitis				+				"
36.	Calculus					+			Cured
37.	" (?)								Improved
38 to 41.	Chronic pyelitis								Cured
42 to 49.	" "								Improved
50 to 55.	Cystitis								Cured
56 to 58.	"								Improved
59.	Acute pyelitis		+			+			Cured
60.	" "					+			"
61.	" "		+						"
62.	" "					+	+		"
63.	" "			+	+		+		"
64 to 76.	" "								"

these symptoms were present, and (2) 49 cases, 31 being chronic, in which these symptoms were either *wholly absent* or (in 9 cases) *only one* was present, and 18 being acute pyelitis, some of these presenting symptoms. As the tables show, all the serious types of the disease, and all the deaths save one, fall into the first group. I think, therefore, that one may take it as a guide, that if a case of chronic pyuria has none or (apart, perhaps, from cachexia and the male sex, which have a

special significance) only one of these features, the probability is that it will clear up under medical treatment, and that pending the result of this it is not immediately necessary to proceed further with its investigation. The group of acute pyelitis cases do not present any difficulty from this point of view.

Calculus.—The presence in the urine of a few casts is perhaps more suggestive of stone than of any other of the conditions we are dealing with. Of the cases of calculus in this series, two died. One was an imbecile child admitted on account of hæmorrhagic purpura which was fatal two days later. He had an abscess in the kidney pelvis with a large coralline calculus, the condition being secondary to phimosis with hypertrophy and dilatation of the bladder and ureters. The other fatal case was a girl who was in hospital in 1905, when radiography of the kidneys was in its infancy. She was discharged unimproved and died eighteen months later in the Royal Infirmary without being operated on. Of the two cases which fall into group two, one was a girl aged three who passed numerous small phosphatic calculi, and who was cured by dilatation of the urethra and the administration of urotropine; the calculi were secondary to a proteus infection with alkaline urine. The other was also a girl, in whom the cystoscope showed a calculus in one ureter; it was subsequently passed *per urethram*, and recovery ensued. In a fifth case, a boy, the stone was in the bladder. There was no pain, and little pus, but the association of a staphylococcus aureus infection with the male sex led to his being cystoscoped immediately after admission, when the stone was seen. The two others were renal calculi, which were cured by operation. The number of cases of calculus is small, but it must be remembered that we are dealing only with patients admitted to the medical side of the hospital, and most cases of stone, probably, go direct to the surgeon.

There remains to be noted the only death which occurred in the second group—the "benign" cases—because it involves a question of diagnosis which may present difficulty, namely, the distinction between primary coli infection of the urinary tract and the coli infection which is not uncommonly met with in tuberculous meningitis. The patient in question (No. 29) was a baby aged three and a half months who had a history of rigors, and whose urine contained pus and *B. coli*. Under

citrate she improved to some extent, but as there was at first some doubt as to the diagnosis she was lumbar punctured soon after admission, and the fluid was found to be normal. The von Pirquet test was also negative. Thirteen weeks later she developed meningeal symptoms with excess of albumin lymphocytes, and absence of the reducing substance in the cerebro-spinal fluid, and died. There was no sectio. The view taken was that the baby had had a coli pyelitis, and that the meningitis which developed later was a separate affair altogether. The way in which, clinically, the difficulty usually presents itself is when a child of two or three years old is ailing with the indefinite symptoms—pyrexia, fretfulness, vomiting—which characterise the onset of tuberculous meningitis, and when as the only positive finding there are pus cells and colon bacilli in the urine. The fallacy can be avoided by remembering that while fretfulness and irritability accompany pyelitis in *young* children, they are not specially characteristic of the disease in older children, of the age at which tuberculous meningitis is common. As the mistake is a serious one, a diagnosis of pyelitis as against meningitis should not be made until the latter has been excluded by lumbar puncture.

The only other diagnostic difficulty which needs mention is the differentiation of right-sided pyelitis from appendicitis. Two of the cases in this series were sent to the surgical side as appendicitis: one was operated on and the appendix was found to be healthy; the presence of pus in the urine was recognised in the other. In both cases the attack apparently occurred as an acute acerbation of a chronic pyelitis, and the symptoms simulated appendicitis very closely indeed.

Treatment.—The first thing is to keep the child in bed. Many of these cases, which have persisted for months at home recover within a few weeks in hospital, and probably the enforced rest has a good deal to do with this. Abundant fluid should be given. Contrary to what is found in the acute form of the disease, the alkaline treatment is no use whatever in chronic pyelitis, but does harm rather than good. The most useful remedy is hexamine in doses of from 3 to 10 grains thrice daily. When the urine is neutral or alkaline, as for instance in proteus and most staphylococcal infections, hexamine should be combined with sodium acid phosphate in 10-grain doses. In some cases benefit seems to follow the administration of salol, either alternately with or in addition to hexamine.

Vaccines appear to be of little use in this condition. I have notes of two cases which were cured, and one which was improved, by an autogenous coli vaccine, but in a much larger number no result whatever was observed. Irrigation of the bladder is very seldom required, but some of the worse cases in older girls, with abundant pus and frequent painful micturition, were benefited to some extent. It is probable, however, that in some of these cases, especially the earlier one, a removable surgical cause may have existed. Operative treatment does not fall within the scope of this paper, but the experience of the last few years leads me to advise that an exploratory operation should at least be considered in all cases of pyuria of long standing which prove rebellious to medical treatment, even if no definite proof of stone or tubercle can be obtained.

SOME FACTORS MODIFYING THE NUTRITION OF CHILDREN: A SURVEY OF 3000 OF THE MOST MARKED CASES OF MALNUTRITION IN VIENNESE CHILDREN, MADE IN THE SUMMER OF 1921.

By MADGE R. GRIBBON.

ANY information as regards factors which tend to determine the persistence of a condition of malnutrition in children is of importance, and advantage has been taken of a somewhat exceptional opportunity of studying these in the case of a large number of badly nourished children in Vienna during the summer of 1921.

Since the Friends Relief Mission have been feeding the children of Vienna from 1919 over 72,000 have been dealt with.

Most of the children were born and reared in Vienna, there being very few foreigners amongst them. These children have been under medical superintendence, and for purposes of administration have been classified each two months, in the following groups :—

O. "*Normal.*"—Those who were in good health and who have never received the ration.

A. "*Gesund.*"—Those who were in fair health and who showed no active disease and who no longer received the ration.

B. "*Schlecht.*"—Those who were in bad condition and were still receiving the ration.

C. "*Sehr Schlecht.*"—Those who were in the worst condition who were also receiving the ration.

After 1st July, there remained in class C. a large number, 3000 of which form the material for the following study. As a control, 300 A. class children were examined as well.

Method.—The investigation was carried out as follows :—

A trained social worker visited the homes of these children in every district of the city. About four to five visits were made in a day. A schedule for collection of information was used (see Appendix). These schedules were brought to the Central Office, and each visitor was interviewed to ensure that nothing had been left out of the report.

Results.—*Nutrition of Children*—Without discussing the best method of expressing the nutrition of children of different ages, in the present investigation weight for age has been taken as the standard.

TABLE I.—*Average Weights in kilos of Children in A. and C. Class compared with Normal Standard.*

Year.	Normal.	A.		C.	
		Actual.	Difference from Normal.	Actual.	Difference from Normal.
6/12 . . .	7·9	...	...	6·0	1·9
9/12 . . .	8·8	7·5	1·3	6·2	2·8
1 year . .	10·2	8·0	2·2	7·5	3·7
2 „ . . .	12·7	10·0	2·7	10·2	2·0
3 „ . . .	14·7	13·5	1·0	11·7	3·0
4 „ . . .	15·9	14·5	1·9	14·5	1·4
5 „ . . .	18·0	17·7	0·3	16·5	1·5
6 „ . . .	20·5	18·5	1·5	18·0	2·0

Table I. shows:—(1) That the children of both A. and C. class were below the normal standard taking the figures for Viennese children used in the Pirquet Clinique.

(2) That the C. children average about 0·8 kilos less than the A. children.

Class A. averaged 1·5 kilos less than normal.

Class C. averaged 2·3 kilos less.

It is probable that the children of A. class are still suffering from the effects of prolonged malnutrition since they are so markedly below the normal standard.

1. *Influence of Disease.*—The question of how far the division of children into A. and C. is dependent upon health, *i.e.*, absence or presence of illness, requires consideration.

The following table shows a very marked difference.

	A.	C.
No manifest disease . .	52 per cent.	10 per cent.
Manifest disease . . .	48 „	90 „

When the incidence of the commoner disease is classified the following result is obtained.

	A.	C.
Tuberculosis	10 per cent.	20 per cent.
Rickets, Active and Inactive . .	14 „	35 „
All other ailments	24 „	35 „
No manifest disease . . .	52 „	10 „

TABLE II.—*Weights in kilos of C. Class Children.*

Year.	No Ailment.	Tuberculosis.	Rachitic.	Other Ailments.
6/12	6·3	4·5	6·0	6·0
1 year	7·5	6·5	7·2	7·5
2 „	10·5	10·0	10·2	10·0
3 „	11·7	10·5	11·7	11·5
4 „	14·9	11·5	12·0	14·7
5 „	16·2	14·0	14·5	16·6
6 „	18·2	17·0	17·5	17·5

As was to be expected tuberculosis has the most marked effect on the nutrition, the tubercular children averaging about 2·4 kilos less in weight than those without ailment, while rachitic children averaged about 1·6 less in weight, and children with other ailments about 1 kilo less.

2. *The Size of Family and Position of C. Child in Family.*—Two factors, the possible influence of which had to be considered, are the size of the family and the position of the child in the family, since, as is well known, the care of the younger children in large families is apt to be less satisfactory than that bestowed on the first children.

The following tables show that these have a considerable significance.

	No. of Children. A.	C.
Average size of family . . .	2	5
Pregnancies	3	6

In the group A. there were no families with more than 4 living children, whilst those of C. group go up to 18, *i.e.*, *the C. children were generally in the larger families.*

Of the A. group

7 per cent. was the only child.
24 „ „ 2nd child in family.
49 „ „ 3rd „ „
20 „ „ 4th „ „

The third and fourth were in each case the last born.

Group C. may be divided into three classes:—

(1) Living Children . . 1-4 39 per cent.
(2) „ „ . . . 5-9 45 „
(3) „ „ . . . 9-18 16 „

In the first class the

C. child was the only child in 20 per cent.
„ „ 2nd child in 20 „
„ „ last child in 60 „.

In the second class it is the

5th or 6th child in 30 per cent.
last child in 70 per cent.

In the third class it was in every case the last born which was in the C. class.

It thus seems that the *position of the C. child is generally amongst the last three of the family.*

3. *Parental Care.*—As a general rule the mother was clean and contrasted favourably with the slatternly women so often seen in the slums of our large towns. Nevertheless it was thought desirable to class the character of the mother under three headings—good, fair, and bad, in accordance with the estimate formed by the visitor of the care she took of the children. A study of the children of mothers of these three groups shows no distinct difference.

4. *Cleanliness of the House.*—Cleanliness of the house is closely associated with the character of the mother, and in Vienna nothing like the filth and squalor which exists in the slums in this country are to be seen.

On classifying the houses as clean, fair, and dirty, no difference could be made out between those of families with C. children and those of families with A. class children.

	A.	C.
Clean . . .	50 per cent.	48 per cent.
Fair . . .	30 „	32 „
Dirty . . .	20 „	20 „

5. *Air Space per Person.*—In the houses in Vienna the average air space per person is generally greater than in the case of the houses of the poorer classes of our industrial towns, and in few does it fall below 400 cub. ft. The approaches to the rooms are considerably better, more airy, and on the whole cleaner than in the dwellings of the corresponding class of the population in this country. The town is not so congested, there being many open spaces with gardens where the poorer classes come out and sit and the children play.

No relation could be determined between the air space per person and the condition of the children.

6. *Income.*—It might be thought that the nutrition of the children would be modified by the income of the family, but since the feeding of the children has been undertaken by the Friends Relief Mission it is not surprising to find that there is little relation between the nutrition of the child and the money available.

The average income of families with A. class children has always been better than those with children classified as C. class.

Average Income.

1917-18 . .	A. 48 Kronen per week.	
	C. 38	„ „
1920-21 . .	A. 2700	„ „
	C. 2100	„ „

7. *Diet.*—In the present investigation the dietary factor was not directly studied as this had been already done (*The Lancet*, 1921, i., 474, and 1921, ii., 747). The food supply of the children in C. class was actually better than that in A. class since the latter were no longer receiving the ration from the Relief Mission.

The next table is of interest as showing the average duration of breast-feeding from 1915-1920.

During the years of	A. On breast.	C. On breast.
1919-20 . . .	12/12	11/12
1918-19 . . .	1 year, 1/12	1 year, 7/12
1917-18 . . .	1 „ 2/12	1 „ 2/12
1916-17 . . .	12/12	10/12
1915-16 . . .	10/12	8/12

It shows that the children in 1917 and 1918 were breast-fed for a very long period. It was at this time that the milk famine was at its height.

Conclusion.—The examination of the data seems to show that the main factors determining the continuance of the children in the C. group has been :—1st, illness ; 2nd, the size of the family ; and 3rd, the position of the child in the family.

These are the conditions which, in spite of the feeding of the children by the Friends Relief Mission, seem to have militated against improvement in their condition.

I have pleasure in acknowledging financial help from the Medical Research Council in carrying out this work, and in thanking Prof. Noël Paton for help in the preparation of this Report.

APPENDIX.

Schedule used.

Name of Family — Date

Address

Clinique — Name of Investigator

Members of Family — Names

Living or Dead — Age — General Health

In case of Death—Cause

Is Child Legitimate or Illegitimate?

Name of Child specially concerned to be underlined

Social Position of Parents—Married or Unmarried?

Father / Mother { Nationality and Religion } { Employment / Regular or Irregular / Former Work } { Habits and Special Items of Interest }

Condition of House—Describe both Mode of Living and Character of Rooms

Number of Rooms — Number of Beds

Size of Rooms — Number of Rooms Used

Number of Windows — Number of Lodgers

Cleanliness — Ventilation

Sanitation

Weekly Income 1917-1918 Kronen — Spent 1917-18

„ 1921 — „ 1921

Feeding of Child — Method of Cooking — Condition of Clothing

Any Items which deal with the Present Living or Former History of the Family

General Remarks

VARIOLA IN BAGHDAD.

Notes regarding the 168 Civilian Cases of Variola admitted to the Civil Isolation Hospital, Baghdad, during the Autumn Epidemic of 1921.

By H. C. SINDERSON, M.B., Ch.B., M.R.C.P.E., D.T.M.,
Iraq Health Service.

Origin of Epidemic.—The first case reported was on 9th August; the patient was a Kurdish boy aged 3 months, living in the large Kurdish itinerants' camp which, owing to lack of accommodation in Baghdad, sprang up on the eastern side of the city beyond Bab-El-Sheikh. On 10th August 2 cases were reported at the same camp, and on 11th August 4 cases more were found; in twenty-one weeks 168 cases were notified in the city and outskirts.

It might here be noted that voluntary notification by relatives did not, on any occasion, occur; the staff of the Medical Officer of Health had to search for the cases and, incidentally, overcome many stratagems in so doing. The local people are not as a whole educated up to hospital treatment, and the idea of an isolation hospital to most of them presents innumerable terrors. As an instance of the efforts at concealment practised, mention might be made of the removal of cases by the camp people into the desert by day and returning with them at nightfall, when inspection for the day had ceased. Particularly so was concealment resorted to with regard to male children—the opposite sex is not so valued in this country, and so without the same difficulty female children were obtainable for hospital treatment.

Spread of the Epidemic. — At first the epidemic was confined to the camp, but gradually the portion of the town nearest to the camp became infected. This is a Mohammedan quarter, and the first 30 cases admitted were among the Mohammedans; after that time, however, the disease spread into the city, and the Jewish community supplied the majority of patients. It must be noted that, by no means, were all the cases admitted during the first few days of their illness, but, in spite of this, the gradual spread from mohalla to mohalla northward is in the main traceable. From the Kurdish camp the nearest mohalla became infected. Sug-al-Ghazal

supplied the next 2 cases, both of which, however, were imported; both cases were pilgrims passing through Baghdad. (During the period under review many parts of Iraq reported smallpox cases.) The fourth district affected was the Serai area; infection occurred here mainly among Indian subordinate personnel in Government employ, who had among their servants residents of the Bab-El-Sheikh area. Districts Haji Fatah, Tatran, and Beni Said were apparently infected from Bab-El-Sheikh. By this time so many mohallas were infected that it was not surprising to find a rather irregular spread during this period, but still the tendency was to extend up the Tigris River. The only case admitted from the right bank was on 1/12/21; I attribute the fact that no further cases occurred on the right bank to the onset of very cold weather about this time, which in my opinion broke the back of the epidemic. The districts of Tatran, Bab-El-Sheikh and Beni Said together accounted for 112 cases, or 66 per cent. of the total admissions. These three districts are at once the most populous and the poorest parts of the city; dwellings are over-crowded, insanitary, and huddled together, so that the percentage of persons per square mile could not readily be surpassed anywhere.

The number of admissions for the first eleven weeks amounted to only 38 and then the number went up by leaps and bounds, and the last eleven weeks registered 130 cases—one week alone, the seventeenth, accounting for 30 cases. At the seventeenth week, one feared that the epidemic might assume very serious dimensions, but the end of November and the beginning of December saw a spell of cold weather and the figures dropped in a remarkable manner.

Termination of Epidemic. — The epidemic may be said to have terminated at the end of the year, and to have occupied a period of approximately twenty-one weeks. From the sudden termination which occurred, there can be little doubt that the fall of atmospheric temperature was the main factor in quelling the epidemic. I am inclined to think that the humidity of the atmosphere is a factor in the spread of smallpox, as in some other epidemic diseases such as plague; in November and December the humidity was exceptional in Baghdad. What a big part in the prevention of epidemic diseases heat and cold play in this country.

Sex, Age, Incidence, and Mortality.—Unfortunately, these

figures cannot be taken as representing quite the true percentages, for, as already noted, the male infected children are very carefully hidden, and also, adult females in a purdah country enjoy a relative immunity from examination. Towards the end of the epidemic, severe punishments were introduced for concealment of cases, and it is hoped this may have a beneficial effect in future. The male cases of all ages numbered 78, the female 90. Considering these under two headings, we have :—

(*a*) *Under* 10 *years of age*, 50 males and 89 females.

(*b*) *Over* 10 *years of age*, 28 males and 1 female.

Analysing these figures under (*a*) one is struck by the preponderance of females, but these figures must be much modified through the concealment, as previously mentioned, of the male children.

Under (*b*) the preponderance of male patients is noticeable, but as already noted, the purdah regime amounts in great part for this. Of the 28 male patients, only 10 were natives of the country, 4 were British, and 14 were Indians; all the Indian patients were Government employees living in billets in different parts of the city. The one female patient was a Russian lady aged 25 years, a resident of Baghdad.

It is noteworthy that no cases were admitted to hospital between the ages of 10 and 18 years, and it certainly would appear as if all but a very small percentage of the local population immediately above 10 years of age have either had smallpox or are in possession of a high degree of immunity from some other cause. It is thought that vaccination can hardly be responsible for all this, and though natural immunity is usually considered rare, one is inclined to believe that the Iraqian must be a little more blessed in this respect than most other people.

Above the age of 18, there was again a small incidence at least a little suggestive of some diminution in protection after this age, though possibly accounted for by the fact that re-vaccination in Iraq is very rare. The percentage mortality tended to increase with the continuance of the spread, and reached its height at the end of November, when the epidemic had assumed its maximum both in size and severity.

Out of the 168 cases, there was a total of 43 deaths, giving a percentage of just over 25 for the epidemic. Thirty-eight of the 43 fatal cases were in children under 10 years of age,

of whom there were 139, giving a percentage mortality of 28 per cent.; the percentage of fatal cases over 10 years of age was under 17 per cent. As will be noted by reference to the paragraph headed "Vaccination," the epidemic occurred almost exclusively among non-vaccinated persons, and the percentages are, therefore, to be read as such.

Below the age of 10 years, the deaths were as follow:—

	Males.			Females.			Combined Percentage.
	Admitted.	Deaths.	Percentage	Admitted.	Deaths.	Percentage.	
Under 1 year . .	6	1	16	13	2	15	15·3
1 to 2 years . .	9	3	30	25	12	48	44
2 „ 3 „ . .	10	3	33	23	9	37	36
3 „ 4 „ . .	8	0	...	9	4	44	24
4 „ 5 „ . .	4	0	...	9	2	...	...
5 „ 6 „ . .	3	0	...	4	1	...	...
6 „ 7 „ . .	1	1	...	...	...	...	...
7 „ 8 „ . .	5	0	...	4	0	...	...
8 „ 9 „ . .	2	0	...	...	...	...	...
9 „ 10 „ . .	2	0	...	2	1	...	...
Total . .	50	8	16	89	31	35	28

From these figures it is readily revealed that the two periods, 1 to 2 years and 2 to 3 years, proved the most susceptible to infection, and also gave the highest death rate. One is at first rather surprised at the low mortality for the patients under 1 year of age, yet when one considers the poor dietary of the vast majority of the children of this city after being weaned, the fact of little resistance at these ages is not so difficult to understand.

Vaccination.—Of the 139 cases under 10 years of age, only in fourteen instances could evidence of successful vaccination be obtained; only one of these cases proved fatal. The efficacy of vaccination as a prophylactic measure and as a definite factor in modifying the severity of the illness has too often been proved to need further comment here. Of the 29 cases above 10 years of age, 23 had been vaccinated, namely, all the European and Indian patients and 4 of the 10 local Mohammedans.

One European, a Britisher, and 4 of the 6 non-vaccinated Arabs died. It is, perhaps, of interest to note that no Jewish

admission occurred above the age of 10 years, but vaccination being more practised among the Jews than among the Mohammedans in Iraq probably accounts for this disparity between the two races. The fatal British case was an imported one infected in Persia and hæmorrhagic in type; the patient had been vaccinated in childhood only, and he was over 50 years of age on admission.

Race Incidence.—The epidemic was not uniformly scattered about the city, and certain quarters, both Jewish and Mohammedan, escaped; it is not considered, therefore, that one's figures are of sufficient value to publish as definitely showing race incidence, though it would appear that the Jewish community maintains a higher percentage incidence together with a higher death rate than the Mohammedans.

Of the 29 cases above the age of 10 years, 19 cases occurred in Europeans and Indians, who comprise a relatively small proportion of the population; this is, probably, in part explained by the fact that no concealment was possible with these cases, though the Indians would also appear to be more susceptible to infection than the local people. All the Indian patients had been successfully vaccinated, and none of these cases terminated fatally—one of these cases was very definitely confluent.

Clinical Notes.—*Types of Variola assumed*—(*a*) 6 cases were of the hæmorrhagic variety, 3 being purpura variolosa and 3 variola hæmorrhagica pustulosa; all these cases proved fatal.

(*b*) 12 cases were definitely confluent, all but 4 being adult cases, and all non-vaccinated except 1·5 of these cases died.

(*c*) 14 cases assumed the varioloid type; 10 were in vaccinated persons, and all of the 14 cases terminated in recovery.

(*d*) 136 cases were of the discrete or semi-confluent type; 34 were of the latter variety, and of the whole 136 cases only 16 could be considered mild. The semi-confluent type among young children proved very fatal.

Complications—(*a*) *Conjunctivitis*, catarrhal and purulent, occurred in 30 cases; many cases were admitted with conjunctivitis of many weeks' duration prior to smallpox occurring, and some of these proved on bacteriological examination to be gonorrhœal.

(*b*) *Iritis* occurred in 9 cases, and in 4 cases definite *pocks* were formed on an eyeball.

(*c*) *Bronchitis* occurred in 22 cases.

(*d*) *Broncho-pneumonia* occurred in 5 fatal cases.

(*e*) *Laryngitis* occurred in 10 cases.

(*f*) *Albuminuria.* There being so few adults urinary examination was found very difficult, though a definite incidence of albuminuria was noted.

(*g*) *Phagedænic ulceration and gangrene* occurred in 5 fatal cases.

(*h*) *Arthritis* occurred in 6 cases—all children. (1) *Purulent* occurred in 2 fatal cases; in each case both elbow-joints were affected. (2) *Non-purulent* occurred in 4 non-fatal cases in elbow-joints only.

(*i*) *Boils and abscesses* occurred during convalescence in 10 cases.

(*j*) *Pitting* was not a marked feature, even in the severest cases that recovered.

(*k*) *Unusual Phenomena*:—

(1) 3 cases occurred among contacts in which vaccination took place with marked effect, but during the stage of scabbing smallpox supervened. Infection and vaccination must have occurred almost simultaneously in these cases.

(2) In 1 case, a male child aged 3 years, a mild discrete type, during the scabbing stage (a fortnight after pustulation had occurred) a fresh crop of small discrete vesicles appeared which later pustulated and scabbed. This phenomenon was associated with pyrexia and was in every way like an initial mild smallpox case.

Convalescence was apparently complete after a fortnight, but then a further crop of vesicles occurred associated with mild fever. This time, however, they were few in number; convalescence was normal and there was no further recurrence of vesicles afterwards.

Treatment.—With very limited trained staff, the daily inunction of the children in an oily preparation consisting of 0.1 arachis, eucalyptus, and carbolic acid proved very satisfactory in all stages of the disease and in addition eliminated to some extent the unpleasant odour which these cases emanate, particularly in Eastern countries.

With adults, weak applications of the tincture of iodine were used in the early stages of the disease with good results,

and the oily preparation above mentioned during the scabbing stage. Red light therapy was given a trial in suitable cases; no perceptible advantage was noted, however, by its application.

It might here be noted that in order to induce parents to send children to hospital for admission, a child's mother or other female relation was allowed to remain with it. Without the admission of these contacts, there is little doubt that much more concealment of cases would have occurred. It may be of interest to record that none of these contacts became infected with the disease, though, of course, all of them were vaccinated on admission.

Summary.—In summarising the epidemic, one notes the marked incidence of the disease together with high mortality between the ages 1 and 3 and the relative absence of cases above the age of 10 years; one notes also the gradual spread of the disease from mohalla to mohalla and the sudden termination of the epidemic on the approach of the cold weather.

In conclusion, I beg to express my thanks to Dr K. V. Nanukutti Nair for much assistance in preparing these notes.

OBSERVATIONS ON SPINAL ANÆSTHESIA.

By D. N. KALYANVALA, M.R.C.S. Eng., Late Assistant Medical Superintendent, Chelsea Infirmary, London.

(*Continued from page* 273, *Vol. XXVIII.*)

Troublesome Features during and after Spinal Anæsthesia.

Difficulty in Entering the Theca.—Personally I prefer to puncture the theca in the lateral posture, though in some cases I have found it difficult to do so, and at times even failed. Invariably the causes of failure were:—(*a*) Unusually fat subjects. (*b*) Difficulty of bending the spine owing to a large abdominal tumour. (*c*) Deformity of the spine, or its compensatory rigidity due to a diseased lower extremity. (*d*) In some patients, the mental condition under omnopon and scopolamine was such that they could not understand the order to flex the spine. In such cases an experienced nurse usually succeeded in manipulating the spine; if not, the sitting posture was adopted as an alternative.

The puncture is made almost vertically in the *central* line, just above the upper border of the lower spine. This will be found distinctly easier, and more satisfactory. I have noticed two cases of unilateral and incomplete anæsthesia when the needle was inserted sideways, and obliquely. In one of the cases it was disappointing both to the anæsthetist and the patient to find the wrong side anæsthetised before the required side. Possibly this was due to the injection of glucose stovaine solution in the sitting posture, and the solution may have got fixed in a group of nerve fibres of the cauda.

One of the difficulties in puncturing the theca is due to not properly anæsthetising the skin and the tract of the puncture. If the patient is very neurotic, the ethyl chloride spray is used, and then the skin and the tract, especially near the bone, are infiltrated with B. eucaine adrenalin solution. This infiltration with local anæsthesia has two advantages. It prevents the unnecessary pain and sudden flinching, and it also gives a fair idea of the anatomical condition of the spine before attempting the lumbar puncture. The direction of the local anæsthesia needle is a very fair guide for the lumbar puncture needle.

I am convinced that lack of experience or of gentleness in

performing the puncture producing unnecessary damage to the part, and irritation of the theca, is in many cases responsible for the post-operative headache of the occipital type. I shall describe this in detail later on when I discuss the subject of headaches.

The Uncertainty of Action.—The diffusion was incomplete and unsatisfactory only when glucose stovaine solution was used. In two cases the solutions had no effect whatever. On making inquiries, in one case the most likely cause of failure was supposed to be sterilisation of the needle and syringe, in a steriliser in which soda had been used. The other case was undoubtedly a genuine case of personal immunity (Cases 38-52). In this case I had used glucose stovaine solution on one occasion and saline stovaine on another. On both these occasions the punctures were quite easy and successful, yet there was no response.

Regarding the loss of sensations — pain, cold, heat, and pressure disappeared in the order described, and reappeared in the reverse order. It was found on several occasions that patients complained of feeling hot swabs though they did not feel stitches in the skin.

Disturbance of Respiration. — This was noticed on two occasions: one was a case of gastric ulcer with a blood pressure of 110 mm., and a high injection was given (Case 33); another a case of fibroid uterus having a blood pressure of 115 mm. and the injection was given between the second and third lumbar spines (Case 57). In both patients the general condition was low. The intra-spinal pressure in the first case was normal (6 in.) but was lowered to 2 in. with a view to getting better diffusion. In the second it was low ($2\frac{1}{2}$ in.) to start with, so that the injection was made without withdrawing any fluid. On both occasions full doses of stovaine saline solution were given with a view to maintain a longer period of anæsthesia, and the head was kept low, as the solution was thought to be light. In both cases the solution diffused to a dangerously high level. In about five minutes the blood pressure fell to 80 mm., the breathing became very shallow and completely stopped. There was a complete cessation of the diaphragm in one case for ten minutes, in another twenty-eight minutes. The face remained cyanosed for a few minutes, but by artificial respiration the colour gradually became normal, although there was no movement of the diaphragm.

Oxygen, strychnine, and pituitarin were also used. The pulse at the radial was quite perceptible and regular throughout. I think this condition was very likely due to primary paralysis of the intercostals and phrenic nerves, and not due to paralysis of respiratory centre.

If the respiratory centre were paralysed the cardiac centre would have been equally prone to paralysis; that it was not so was noticed by the regularity of heart's action. Also the readiness with which the respiration started (in one case after twenty-eight minutes) when the diaphragm began to act shows that the respiratory centre could not have been paralysed. I have had cases of considerable fall of blood pressure with slowing but without any cessation of respiration. In the two cases of respiratory failure the blood pressure which had fallen down to 80 mm. did not rise *pari passu* with the re-establishment of respiration, showing that the fall of blood pressure could not be responsible for the cessation of respiration.

These two cases indicate that whenever the patient's condition is poor or the intra-spinal pressure low :—

(*a*) More than half the dose should not be administered no matter what the operation may be ;
(*b*) The head should be elevated longer than in other cases, *i.e.* for about ten minutes ; and
(*c*) The intra-spinal pressure should not be lowered by withdrawing any fluid.

Ever since I have followed these three rules I have had no cause for anxiety.

Fall of Blood Pressure.—From the blood pressure readings which were taken immediately after the puncture, a preliminary rise of 10 to 15 mm. was often noticed. This was soon followed by a fall, which can be divided into two types :—

(*a*) Slight and transient fall of blood pressure in early stages, often preceded by restlessness and shivering, or accompanied by retching. A similar condition was noticed at times in nervous individuals, even after simple lumbar punctures for diagnostic purposes, and it seemed allied to a nervous fainting. There was no cause for any anxiety as the condition improved by simple measures, such as suggestions or by giving sips of water. I have noticed that twilight sleep is

decidedly beneficial in preventing these nervous manifestations, and they have been distinctly less since its use.

(*b*) The fall of the blood pressure in most cases was gradual, ranging from 10 to 20 mm., in others from 30 to 40 mm., whilst on two occasions it was 60 mm. (in Case No. 29 from 140 to 80 mm.; in Case No. 48 from 110 to 50 mm.).

The usual time of onset was from ten to fifteen minutes after injection. It appeared to be delayed when the patient was in Trendelenburg's position. In most of the cases it was marked when the anæsthesia reached a high level. The duration of low blood pressure appeared to depend more upon the dose of stovaine injected than any other factor. The fall of the blood pressure was invariably accompanied by retching or vomiting, unless the patient was under deep twilight sleep or in a very exhausted condition. It was noticed to rise about 10 mm. after the act of vomiting. A few cases caused temporary anxiety, but the patients' condition improved by measures taken to raise the blood pressure, such as compression of the abdomen, raising the extremities, or adoption of Trendelenburg's position. In cases of cardiac or respiratory diseases this latter position should be cautiously adopted. It is my experience that compression of the abdomen and raising the legs up in the air are more efficacious than mere Trendelenburg's position. The use of pituitarin proved useful in some cases by acting more as a cardiac stimulant; the blood-pressure readings showed only a temporary rise of 10 to 20 mm.

Several factors appear to be responsible for this fall of blood pressure.

(A) *Splanchnic Paralysis.*—Several times on opening the abdominal cavity congestion of the splanchnic vessels was noticed; in some cases there was also active peristalsis. This seems to be due to the paralysing action of stovaine on the splanchnic fibres in the anterior nerve roots as they traverse the sub-arachnoid space, and not on the vaso-motor centre in the medulla. We know that other centres in the medulla would be equally prone to paralysis, or even liable to be paralysed before the vaso-motor centre, which is the most resistant centre. I have had cases of serious fall of the blood pressure (down

to 50 mm.) without any irregularity of heart's action or cessation of respiration, showing that the higher centres were not actually involved. Further, if the fall were due to interference with the vaso-motor centre or with the fibres connecting it with the vaso-motor cells in the spinal chord, the fall of the blood pressure would necessarily have been greater with two cases of high anæsthesias (Cases 33-57) where there was actual paresis of the phrenic nerves, but it was not so. There were other cases where the fall of the blood pressure was greater though the level of the anæsthesia was not quite so high. The fact that the fall of blood pressure reached its maximum point when the solution reached the first dorsal segment proved that the total paresis of all the splanchnic fibres in the nerve roots had taken place and the higher diffusion of the fluid had very little or practically no action on the vaso-motor centre.

Another factor which might possibly accelerate the fall of blood pressure is the hypo-adrenia or supra-renal inefficiency produced by the loss of the splanchnic nerve supply of the supra-renals and possibly congestion of these glands from vaso dilatation. However, this is purely guesswork.

In connection with the subject of splanchnic paresis I should like to record that occasionally on opening the abdomen I noticed marked *ischæmia* and *shrinkage* of the volume of the gut. The condition lasted from five to fifteen minutes, and was followed by the usual congestion of the splanchnic vessels. To me two factors appear to be responsible for this phenomenon. It may be due to :—

(1) Sheer pain or fear of lumbar puncture producing primary stimulation of the sympathetic system with subsequent hyper-adrenia before stovaine has had time to produce paralysis of the anterior nerve roots. The temporary rise of the blood pressure, tachycardia, and sweating in the early stage very often noticed even after simple lumbar punctures seem to confirm this view ; *or*

(2) It may be due to direct stimulation of the anterior nerve roots by stovaine before producing paresis. In support of this view we have the following facts :—(*a*) That stovaine does stimulate the nerves before paralysing them, as demonstrated by its action on the posterior nerve roots, producing at first tingling, and then analgesia ; and in the case of the anterior nerve roots occasional twitching and tremors of the limbs before paresis. (*b*) That the posterior nerve roots are

paralysed before the anterior, as evidenced by analgesia occurring before motor paresis. (*c*) That this phenomenon was never accompanied by fall of blood pressure, appeared to show that blood pressure was kept up by the vaso-constrictor mechanism ; that is, the anterior nerve roots were not paralysed.

Thus, in summarising, the action of stovaine on the nervous system may be described in the following clinical stages :—

(1) Stimulation of the posterior nerve roots, leading to tingling.

(2) Paralysis of the posterior nerve roots, causing analgesia; accompanied at the same time in the early stages by stimulation of the sympathetic system or anterior nerve roots with subsequent hyperadrenia; resulting in vaso constriction, rise of blood-pressure tachycardia, sweating, occasional twitches or tremors, and priapism (*nervi erigentes*).

(3) Paralysis of the anterior nerve roots with splanchnic paresis and hypoadrenia, producing complete relaxation of the muscles, vaso dilatation, fall of the blood pressure.

(B) *Venous Stasis.*—This would also tend to bring about fall of blood pressure by stagnation of blood in the veins of the extremities and abdomen. It would naturally increase with the height of anæsthesia. The factors which would produce venous stasis are :—(*a*) Complete relaxation of the muscles of the limbs and abdomen. (*b*) Decreased intra-abdominal pressure; more marked when abdomen is opened. (*c*) Paresis of the intercostal muscles, producing impaired thoracic breathing culminating into diminished aspiration of thorax. (*d*) The natural absence of functional valves in the abdominal veins.

These are the different factors which would account for the fall of blood pressure during spinal anæsthesia. The blood pressure rises to its normal level after the anæsthesia has passed off. Sometimes it may remain low or may again fall later on, and may be due in some cases to post-operative shock. This leads us to a very important subject of :—

Secondary or Post-operative Shock, and its Relations to Spinal Anæsthesia.—In spite of complete blockage of the afferent nerve impulses, the existence of post-operative shock after spinal anæsthesia cannot be entirely refuted. Naturally there must be some other factor or factors besides the nerve impulses responsible for this shock. We know that shock is favoured by factors, such as a previous hæmorrhage or pre-

existing toxins; there is no doubt, however, that it is occasionally noticed after operations which are notorious for prolonged and difficult manipulations of viscera. Evidently there must be some other factors besides nervous impulses responsible for shock. To me the theory of chemical toxæmia, or as it is known as traumatic toxæmia, appears to be most likely (Bayliss and Ludlaw). It would therefore seem to be a mistake to think that patients would not suffer from shock because all afferent nerve impulses are prevented from reaching the brain; spinal anæsthesia may prevent the nerve impulses, but it cannot possibly prevent the circulation in the blood of traumatic toxins (allied to histamines) produced by rough or prolonged manipulations. Avoidance of bleeding, or of undue exposure of viscera, and gentleness in manipulations are therefore very important factors in the prevention of shock.

These clinical studies of blood pressures at different periods under spinal anæsthesia appear to be of some indirect value in throwing light upon the present position of shock and its relations to this form of anæsthesia. They show that a slight fall of blood pressure after a preliminary rise is purely of psychical origin allied to a nervous faint, and is preventable by inducing scopolamine sleep or by the administration of a few whiffs of a general anæsthetic. That post-operative shock, after spinal anæsthesia is reduced to a great extent, not only (*a*) by blockage of nerve impulses, but also (*b*) by comparative absence of traumatic toxæmia due to easy manipulations of viscera afforded by complete relaxation of muscles. This continuous and perfect relaxation cannot be obtained without seriously affecting the condition of the patient by any other form of general anæsthesia.

However valuable spinal anæsthesia may be in preventing shock, where there is a pre-operative shock or in any condition where the blood pressure is below 100 mm. its use is dangerous. The practice of using it in cases where patients appear too ill to stand general anæsthesia is most undesirable, and for this reason I consider the routine of taking the blood pressure a distinct safeguard against a catastrophe. It is also dangerous in myocardial degeneration and in aortic disease. Personally I do not consider arteriosclerosis or old age as contra-indications, unless there is a fatty or myocardial degeneration of the heart muscle or a very high "pulse pressure," *i.e.*, the difference between systolic and diastolic pressures. In this

series of 18 cases, 22 had arteriosclerosis, and 33 patients were over 60 years of age.

Retching and Vomiting during Operation.—This subject has been widely debated, and several theories have been put forward. In trying to find the rationale, the weight of evidence is in favour of fall of blood pressure due to the following facts:—(*a*) The time of onset of vomiting in most cases was from ten to twenty minutes after the injection, just the time when the fall of the blood pressure was noticed. (*b*) The blood pressure was always recorded falling during vomiting, and it was noticed to be rising about 10 mm. after the act of vomiting. This shows that the act of vomiting was merely nature's attempt to raise the blood pressure. (*c*) Measures taken to raise the blood pressure, such as lifting the legs up in the air, compression of the abdomen, or Trendelenburg's position, appeared to relieve the condition. (*d*) The higher the level of anæsthesia the greater was the fall of blood pressure and greater the tendency to vomiting. (*e*) Whenever the fall of blood pressure was below 90 mm. vomiting was noticed, unless the patient was exhausted or was under deep twilight sleep. If it was over 95 or 100 mm. only slight retching or thirst was complained of. (*f*) Pallor of the face was invariably present, quite unlike the congestion and lividity of post-operative vomiting.

Whatever may be the cause, the condition of the patient's nervous system appears to be an important factor in considering the ætiology of vomiting. Nervous patients, owing to their highly sensitive and impressionable system, are decidedly more prone to suffer. I have also found this trouble more common in women than in men. It was noticed that patients who were under the effects of twilight sleep or who had whiffs of general anæsthesia, or whose nervous system was exhausted, by previous toxæmia and cachexia, were distinctly less liable to suffer from it. I have performed high-level operations accompanied with marked fall of blood pressure, *e.g.*, suturing of a perforated gastric ulcer—gastrotomy—without the patient even retching; whereas troublesome retching and vomiting were noticed at times with low-level operations amongst neurotic individuals.

Post-operative Vomiting. — From clinical experience one can divide this into two types:—

(1) That which is probably due to the pharmacological action of the drug employed. The clinical picture is very

clear. The patient's face is invariably flushed; he may complain of frontal headache, or may perspire very freely, and suffer from great thirst. The vomiting is of a regurgitant type and very often mixed with pure bile. In one or two cases it was of slightly coffee-ground colour. It is not preceded by sensation of giddiness, nor was there any fall of the blood pressure. It appeared more often when full doses of stovaine were administered. It is rarely troublesome, indeed it is much less troublesome than that following general anæsthesia, and is not accompanied by constant straining and retching, which is noticed after the latter.

(2) I will describe vomiting, noticed as one of the symptoms of meningeal irritation, presently in connection with post-operative headaches.

Treatment of post-operative vomiting is to give cold water *ad lib.* In bad cases, morphia or omnopon may be given. The patient's head should be kept low.

(*To be continued.*)

CLINICAL RECORD

LATERAL DISLOCATION IN THE LUMBAR SPINE.

(Report of a Case Reduced at Open Operation.)

By J. N. J. HARTLEY, F.R.C.S.

(*From the Clinique of Professor Sir H. J. Stiles.*)

That pure dislocation in the lumbar spine is rare, is evidenced by the scanty mention of cases in literature. Indeed, several authoritative treatises on fractures and dislocations dismiss the subject after making mere reference to its infrequent occurrence. Undoubted cases, however, proved by post-mortem examination, have from time to time been recorded, and amongst these are to be found examples of all possible varieties—forward, backward, and lateral.

The lateral dislocation is by far the rarest type. Recently, Burckhardt,[1] in reporting a case of lateral dislocation between the 12th dorsal and the 1st lumbar vertebræ, complicated, however, by fracture of two transverse processes and one articular process, states that, without the complication of fracture of at least one articular process, lateral dislocation is inconceivable. Nevertheless, the classical example recorded by Charles Bell [2] in 1824 shows that simple lateral dislocation is possible:—A child was run over by a stage-coach, and died of croup thirteen months later. At the post-mortem examination, the last dorsal vertebra was found completely displaced to the left side of the 1st lumbar vertebra, and there was only slight chipping of bone.

The case recorded here is further proof of the possibility of uncomplicated lateral dislocation in this region of the spine, and the case is all the more worthy of record in as much as reduction was effected by manipulation at open operation.

Case.—*Mr A. R., æt.* 38 *years* (from the notes of Dr Abbott).—The patient was shovelling coal, in a kneeling position, with the spine well flexed, when a heavy stone, stated to be 5 ft. broad and 15 in. thick, fell on his back and hips, and pinned him to the ground. He was able partly to extricate himself, the stone sliding down on to his legs, but it was only when assistance came that he was completely freed. Immediately following the injury there was severe pain in the back, and any movement caused excruciating pain referred down the

posterior aspects of the thighs. The patient was transported by ambulance forthwith to the Edinburgh Royal Infirmary.

On admission, he was lying on his side on a stretcher, apparently in great pain and complaining of the slightest movement. Physical examination revealed a large, semi-fluctuating swelling over the lower dorsal and lumbar region, with ecchymosis. Through the superficial swelling one could detect what was thought to be a prominent spinous process. The whole area was so tender that further examination was delayed. There was contusion of the legs but no evidence of fracture, nor was paralysis noted.

The patient was kept in the supine position, and, in a week's time, the fluctuating swelling had partly subsided, leaving only a large area of ecchymosis. It was then possible to make a more thorough examination. On palpation, one could define the spines of the 4th, 3rd, and 2nd lumbar vertebræ, and these were equidistant and in correct alignment. Between the spinous processes of the 1st and 2nd lumbar vertebræ there was a distinct gap, fully one inch greater than between those of the 2nd and 3rd. The 1st lumbar spine bore no abnormal relationship to those above it.

A radiogram was taken of the dorso-lumbar region, and the diagnosis of "lateral dislocation of the 1st lumbar vertebra to the left of the 2nd lumbar vertebra" was established. The inferior articular processes of the 1st lumbar vertebra were distinctly to the left of their normal positions and also at a higher level. The articular processes on the left side were apparently in contact, the medial surface of the upper being adjacent to the lateral aspect of the tip of the one below. Those on the right side were slightly apart, the inferior process of the 1st being medial to and slightly above the articular process of the 2nd. The contour of the bodies and transverse processes was intact and showed no evidence of fracture. The separation of the 1st and 2nd lumbar spines and their disalignment determined by palpation were confirmed in the radiogram.

Treatment (Sir Harold J. Stiles).—On the eleventh day after the injury the patient was anæsthetised and gently placed in the prone position on the operating-table, which was so arranged that, when the movable platform was raised, the lumbar spine was arched backwards. A curved vertical incision was made from the last dorsal to the 3rd lumbar spine. It was then seen that the supraspinous and interspinous ligaments between the 1st and 2nd lumbar spines were ruptured and that the erector spinæ sheath on either side was torn. The tips of the spinous processes of the 1st and 2nd lumbar vertebræ were separated fully $1\frac{1}{2}$ in., and the 1st lay to the left and very slightly in front of the 2nd. The dead space was filled with blood-clot.

By dissection, the spinous processes and the neural arches of the

1st and 2nd lumbar vertebræ were exposed, and here, too, was considerable blood-clot. It was then seen that the right inferior articular process of the 1st lumbar vertebra was to the medial side of the articular process of the 2nd lumbar vertebra, and their tips were in the same horizontal plane. The left lower articular process of the 1st lumbar vertebra was displaced lateral to its companion below and was also at a slightly higher level than normal, so that the extremities of their non-articular surfaces were in contact.

By flexing the lumbar spine still more and applying traction to the 1st and 2nd lumbar spines, the articular processes were readily disengaged, and only gentle local manipulation was necessary to effect correct alignment. In view of the ruptured ligaments, it was deemed advisable to ankylose the articulations, and accordingly the exposed cartilages were removed by chisel and mallet. By lowering the platform, the lumbar spine was straightened and the articular processes of the 1st lumbar vertebra glided between those of the 2nd. After suturing the erector spinæ muscles together, the skin wound was completely closed, and a plaster jacket was applied with the spine in hyper-extension.

Apart from a temporary paresis of the left lower extremity and some difficulty in starting micturition, there was nothing to note in the patient's immediate post-operative history. A window was cut on the eleventh day and the stitches were removed. Within six weeks the patient was out of bed, and walked with the aid of two sticks, and, a few days later, was allowed home.

The patient reported *four months later*. The plaster was bi-valved, and he was told to wear a splint during the day for three months longer. He stated that he passed urine several times involuntarily during the night, and that, to avoid precipitate micturition during the day, he passed urine frequently. He further stated that to obtain an action of the bowels it was necessary to take purgatives every two or three days.

A year after leaving hospital he succeeded in finding temporary employment which entailed little more than sitting. He walked a mile and a half there and back daily, but this he found trying, especially in windy and stormy weather.

The patient was last examined *two years subsequent to his injury*. His general condition was good. Most days he walked about four miles with the aid of only one stick. His gait was a little stiff, and there was a slight stoop in the dorsal region. He still complained of some instability when he leaned forward or flexed the knees, and he occasionally had aching pains radiating from the back to the region of the iliac crests. The 12th dorsal and 1st and 2nd lumbar spines were slightly prominent when the patient stood erect, and the 1st and 2nd

moved *en bloc* when the spine was flexed. All muscle groups were well developed, and no evidence of anæsthetic areas was discovered. The knee-jerks were not exaggerated and the Babinski reflex was negative.

There can be little doubt from the study of the X-ray plates and from the observations made at the operation that here one was dealing with an uncomplicated lateral dislocation between the 1st and 2nd lumbar vertebræ. As to the mechanical factors involved in its production one must presume that, contrary to usual, the strong ligaments binding together the spinous processes and neural arches of the vertebræ yielded to the strain prior to the crushing of the cancellous bone tissue of the bodies of the vertebræ. The articular processes would thereby be disengaged, and rotation of the spine at the time of injury, or possibly the traumatic force being applied obliquely, may have produced lateral displacement. The contraction of the spinal muscles, or simply the weight being removed and the patient being placed in the horizontal position, would then cause interlocking of the displaced articular processes.

The treatment recommended for spinal dislocations by most authorities has been traction, torsion, and local pressure on the spinous processes, but, at the best, such must be a hazardous procedure. Any temporary exaggeration of the displacement may cause irreparable damage to the spinal contents. In the case here recorded, the exposure of the neural arches with their articular processes undoubtedly minimised the risks and facilitated reduction.

Summary.—1. Simple dislocations in the lumbar spine are exceedingly rare, and this is largely explained by the fact that in forced flexion the cancellous bone of the bodies of the vertebræ more readily yields to the strain than the strong ligaments binding the spinous processes and neural arches.

2. Of the various types of dislocation, the least frequent is the lateral variety, and rarely has this been recorded without the complication of fracture of one or both articular processes.

3. Such an uncomplicated case of lateral dislocation between the 1st and 2nd lumbar vertebræ is here recorded.

4. Reduction was effected by manipulation at open operation and the patient made a satisfactory recovery.

5. Exposure of the neural arches and articular processes

undoubtedly facilitated and allowed of a more precise and careful reduction of the dislocation.

6. It is suggested that open operation will prove of value in the reduction of spinal dislocations in their more common sites.

REFERENCES.—[1] H. Burckhardt, *Beit. zur klin. Chirg.*, 123. [2] Charles Bell, *Injuries to the Spine and Thigh-bone*, 1824.

NEW BOOK

Therapeutic Immunization. By W. Ford Robertson. Pp. vii. + 278. Edinburgh: E. & S. Livingstone. 1921.

The task of the exponent of vaccine therapy is an unenviable one. While it is indisputable that the use of vaccines in the prophylaxis and treatment of disease rests on an assured scientific basis, many of the practical applications have only an empirical sanction, and the results obtained are as yet incapable of explanation. Further, the whole procedure lies under disrepute. Though it was in Britain that the fundamental work was done, and though all the essential literature on the subject is in the English language, the medical profession generally has never taken pains to master the underlying principles. Thus the bad results attributed to the use of vaccines are often in reality due to want of knowledge and care on the part of the user. Further, the method has an attraction for a type of mind which, while restless in the pursuit of novelty, is uncritical, and often incapable of distinguishing truth from error. Moreover, it places a considerable strain on Christian charity to attribute to misplaced enthusiasm the attempts of many professional vaccinators to extend their activities to diseases whose bacterial origin is questionable. A scientific consideration of the whole subject is therefore urgently desirable. This Dr Ford Robertson essays in the present volume.

In what may be called the preliminary section of the book the author sets forth his views on the theories underlying therapeutic vaccination; he treats of bacteriological methods, in so far as they concern the diagnosis of the infections to which vaccines are applied, and a description is given of his technique in the preparation of vaccines. The main part of the volume, however, and that which will attract most attention, is devoted to the scope of vaccine therapy, and to an account of experiences in the treatment of a great variety of diseases.

In the earlier chapters there is much that is valuable and suggestive. His insistence, for example, on the application of anaërobic methods both in the identification of bacterial species and in the study of the obviously mixed infections of external and internal body surfaces, emphasises one of the conditions of accurate work to which too little attention is ordinarily paid. Again, his advocacy of hæmoglobin agar as a routine medium in cultural work will find general acceptance. Unfortunately he has completely nullified the value of his observations of growth characters on this medium by inaccurately characterising organisms as hæmolytic which merely require hæmoglobin for their optimum growth. The chapter on the

clinical investigation of infections leaves a good deal to be desired; for instance, no evidence is given that the method of midstream sampling of the urine is sufficiently reliable for accurate work on bacterial infections of the genito-urinary tract, and it is questionable whether in respiratory disease a vaccine should even be made from material which has not been taken by a trained bacteriologist.

When we turn to Dr Ford Robertson's consideration of the scientific basis of vaccine therapy we find him contenting himself with conventional views regarding the pathology of the infection. We would have thought that the vaccine therapist, of all people, would share the growing dissatisfaction with the ordinary conception of endotoxins, whose existence is often hypothetical, as in any way sufficiently accounting for the phenomena of infection. Dr Ford Robertson does not appear to realise that bacteriology, perhaps more than any other branch of science, suffers from the results of generalisation from insufficient data. Because a proximate cause for the characters of such a disease as diphtheria has been found in the toxic filtrates of cultures of the diphtheria bacillus, and because dead cultures of the typhoid bacillus produce toxic results in animals, it by no means follows that the phenomena of typhoid fever are directly due to the endotoxins of the bacillus. No proof has ever been adduced for this position, and it is extremely significant that convincing evidence is still wanting to support the view that such endotoxins are responsible for, or capable of, stimulating the production of antibodies along the lines which hold for the reaction of the animal organism against the diphtheria exotoxin. Yet it is on assumptions of this kind that Dr Ford Robertson bases his ideas on the pathology of infection and on the scientific basis of vaccine therapy. He is thus led to take the position that because the injection of dead bacteria aggravates an existing focus of infection the infection is therefore caused by the species to which these bacteria belong, whether there has been any evidence of the presence of the organisms in the focal lesion or not. It does not seem to have struck Dr Ford Robertson that recent results relating to the toxic action of ordinary food proteins in the animal body raise the whole question of whether the effects of bacteria may not be due to proteins which may be common to many species.

The effects of fundamentally fallacious reasoning appear all through the section of the book which deals with the application of vaccine therapy to individual disease. Whether exophthalmic goitre, disseminated sclerosis, and pernicious anæmia have or have not a bacterial origin, the fact that patients suffering from these diseases manifest a hypersensitiveness to vaccines prepared from diphtheroid bacilli or from the pneumococcus, merely suggests that their reactions to all sorts of dead bacteria should be investigated. It has no bearing

whatever on the etiology of the conditions. How insecure is the basis for deducing a causal nexus between an organism having a therapeutic effect and a disease, is shown by the fact that the author has to presuppose the possession by bacteria of pharmacological properties apart from those by which a reaction of the body is stimulated. Thus he states that while there is little evidence for considering the staphylococcus pyogenes to be a cause of neuralgia and neuritis, practical experience has shown that many cases are benefited by such vaccines.

It is perhaps not to be expected that in a work of this size there should be an adequate discussion of the evidence for differentiating parasitic from saprophytic bacteria. Nevertheless this is a problem which peculiarly concerns the vaccinator, for in so many of his procedures he is dealing with superficial infections of the respiratory or alimentary systems where numerous examples of both groups are existing side by side. Among other aspects of the problem which arise is whether for any bodily surface there is a distribution of bacterial species which can be considered normal for that surface. Dr Ford Robertson makes no contribution to the solution of this problem, and the grounds he puts forward for differentiating a pathogenic from a nonpathogenic variety of an organism are frequently inadequate. Thus his description of the peculiar intestinal pneumococcus which he associates with pernicious anæmia would not enable any bacteriologist to distinguish it from other pneumococci occurring in the same situation. In considering this aspect of the subject, we naturally turn to the discussion of the diphtheroid bacilli with which the author's name has been for many years associated. A paper prepared for publication in 1914 is given *in extenso*, from which we gather that the criteria on which Dr Ford Robertson bases the pathogenicity of at least the most important members of this group are their anaërobic habit, their incapacity to grow at room temperature, their tendency to invade mucous surfaces, and their pathogenicity for mice. These certainly constitute definite characteristics which may be the basis for work by other investigators. The neurotoxic character of the group on which the author insists is, however, deduced from the action produced by vaccines in diseases such as neurasthenia, and, as has been indicated above, such evidence at present cannot be accepted as conclusive.

Looking at the volume from the scientific standpoint, no one can read it without feeling that the author has essentially an honest outlook on the subject, and, further, that by laborious work he is in possession of an enormous mass of facts relating to vaccines. There is, however, the defect that the data are constantly set out in such an incomplete form as to prevent the reader from forming an independent judgment,

and furthermore, there is constantly a failure to marshal an argument in accordance with the ordinary rules governing scientific evidence.

We have the feeling that if honest workers like Dr Ford Robertson would, in the meantime, be content to be frank empiricists, the cause of vaccine therapy would really be much advanced. There are, in reality, few things about vaccines which can be explained, and the true aim at present ought to be the definition of the limits of their therapeutic applications. After all, if a thing works, the explanation of its working is, from the practical standpoint, a secondary matter. From this point of view there is much in Dr Ford Robertson's book which is highly interesting and suggestive. Especially is this true of his applications of vaccine therapy to diseases of the nervous system. It is much to be regretted that he has not taken a series of cases of, say, neurasthenia, and carefully recorded the clinical and pathological history along with a complete account of the successes and failures of vaccine therapy in their treatment. Such records would not only form a substantial basis for practice, but would inevitably shed light on etiology. It is a curious phenomenon that those who practise vaccine therapy have never realised how instructive and impressive even a record of failures can be. Nowhere in this volume do we find any disease treated of along these lines. All through, we have to be content with general statements unsupported by definite data. We cannot, therefore, look upon the book as in any way advancing the cause of scientific therapeutics.

NEW EDITIONS

Clinical Surgical Diagnosis. By F. DE QUERVAIN. Third English Edition. Pp. 914, with 738 illustrations. London: John Bale, Sons, & Danielsson, Ltd. 1921. Price 50s. net.

This work—by the successor of Kocher of Berne—fulfils a definite function. It is essentially clinical, and to the student as well as to the practitioner it will serve as a guide to diagnosis in surgical cases. It represents the fruits of the author's own experiences, and the frequent quotations from cases of his own render the book all the more vivid and practical. He has employed the method, so helpful in actual practice, of considering first the symptoms for which the patient has sought advice, and from these working, wherever possible, to a definite diagnosis. In this respect the book differs widely from text-books of systematic surgery and supplies a want that has been felt by every student.

The present edition has been brought up to date in all respects, and is fully illustrated with excellent photographs and drawings. The lucid and forceful style of the author renders a perusal of the book a pleasure. Special praise must be given to the description of the X-ray investigation of the alimentary tract; this is complete in every detail and perhaps more fully illustrated than in any similar work.

It is evident that the mantle of Kocher has fallen on no unworthy successor, and one cannot fail to be impressed by the originality, as well as by the keenness of intellect, of the author of this book.

Diseases of the Skin. By RICHARD L. SUTTON. Fourth Edition. Pp. 1132, with 969 illustrations. London: Henry Kimpton. 1921. Price 50s. net.

We have read with much pleasure the fourth edition of this excellent work. Especially valuable in our opinion are the excellent illustrations. The coloured illustrations are few but good; and very appropriate at the present time are those illustrating Foot and Mouth Disease in man. The section on Parasitic Diseases is particularly good, and as regards the more recently discovered mycotic eruptions, the literature is quite up to date. It is impossible to do justice in a short space to this compendium, and we can only recommend it to others who will find that the excellent style and clear statements are in keeping with the rest of the work.

NOTES ON BOOKS

Nerve Exhaustion, by Maurice Craig, M.D. (J. & A. Churchill, 1921, price, 6s. net), can unhesitatingly be placed among the good—indeed, the very good—works on the subject. For one thing, the author has had a long experience of this class of case, and his study of psychology is not a mere war product. Except for incidental references to battle, he deals with nerve exhaustion from the point of view of civil practice. The symptomatology of nerve exhaustion is fully discussed, stress being laid equally on its physical and on its mental causes, and the term is extended so as to include many cases which are generally relegated to the "borderland." The importance of basing a diagnosis on objective signs, and not relying on the patient's statements is emphasised. The most important part of the book is the chapter on treatment, which is quite the best presentation of this subject that has been written of late years. It is full of common-sense, and gives both an unprejudiced estimate

of the various types of psychotherapy, and due recognition to the value of physical remedies in the management of the neuroses. The importance from a preventive point of view of the educational and home environment in childhood is clearly explained. Dr Craig is to be congratulated on having kept the balance true between the moral and material both in the causes and treatment of functional nerve disorders, and his book will be widely appreciated on that account as well as for its real value as a practical guide for the practitioner.

Addresses on Psycho-Analysis, by J. J. Putnam, pp. v + 470, *International Psycho-Analytical Library*, *No.* 1 (The International Psycho-Analytical Press, 1921, price 12s. 6d. net) is a valuable collection of papers (there are twenty-two of them) dealing with different aspects of the psycho-analytic movement. The late Dr J. J. Putnam was one of the leading medical representatives of cultured New England humanism. For many years a neurologist, he became captivated after the age of sixty by Freudism, and for fifteen years, up to his death in 1918, was one of the foremost champions in America of psycho-analysis. Apart from its positive elucidation of principles and methods, the chief value of this book lies in its searching criticism of Freud's psychological determinism. This position obviously perplexed the Editors (Freud himself and his London henchman, Ernest Jones), who apparently attribute it to some unexplored "complex" in the amiable doctor's mind. Apart from this the writer shows extreme deference to Freud's views, and to many readers his valiant attempts to prove the "sexual" nature of the infant's ordinary acts (such as sucking its thumb) will appear a trifle overstrained. With a marked desire to be fair to everyone, he gives full consideration to the chief of Freud's opponents, such as Jung and Adler. Like the bulk of psychological specialists, Putnam is too much apt to regard life not as a relation (between organism and environment) but as an entity—in fact as a form of energy ("all-pervading, self-determining," etc.). Similarly he tends to forget that the end of life is an Action and not a Thought. As an exposition, however, of moderate and by no means uncritical Freudism, this book can be cordially recommended; we doubt if there is one better worth reading. The literary style, the level of erudition, and the general tone follow the best traditions of Boston culture. As the book does not pretend to be a unit but is a collection of addresses, there is considerable repetition, but in such a complex subject this is hardly a fault. There is a useful bibliography. An index, if only of proper names, would have been useful.

The first and largest part of *Pulmonary Tuberculosis*, by David C. Muthu, M.D. (Ballière, Tindall & Cox, 1922, price 12s. 6d. net), consists of a discussion of the various factors which predispose to an infection

by the tubercle bacillus. While everyone will admit that the "soil" plays an important part in the production of an infection, it is hardly credible that such an infection can take place without the presence of the tubercle bacillus. The section dealing with diagnosis and treatment does not give enough detail to be of assistance to the practitioner. It seems curious that there should be such scant mention of artificial pneumo-thorax which is now a recognised method of treatment. The last section deals with the disease from the sociological point of view.

The Organs of Internal Secretion, by T. Geikie Cobb (Baillière, Tindall & Cox, 1921, price 10s. 6d. net), has quickly attained to a third edition. Its appeal is to general practitioners who have obviously approved of the author's success in making very easy reading for them. The book may be read by those who wish to be introduced to the subject, and have insufficient opportunity for reading the larger works. At the same time it is necessary to add that the soundest parts of the book are the quotations. The chapters on Human Therapy abound in statements of the author's opinions. When these are entirely his own, the evidence on which the opinion is based should be clearly stated. The book is easy reading, and if the author exercised judgment in cutting out much mere supposition, it could be recommended for the perusal of the uninitiated.

TRANSACTIONS, REPORTS, Etc.

Transactions of the American Gynæcological Society, 1920, edited by George Gray Ward, jun. (Wm. J. Dornan), contains, as usual, many interesting articles. The meeting was held at Chicago, and the President (Dr R. L. Dickinson of New York) gave a thoughtful and original paper on "Suggestions for a Programme for American Gynæcology," including a report on women in gynæcology and obstetrics, and the issuing of a new journal under the auspices of the Society. The President also read a paper on "Artificial Impregnation" which excited a good deal of discussion. Well-illustrated articles were supplied by Dr T. W. Eden of London who dealt with transition stages from benign to malignant conditions of the ovary, and by Dr Litzenberg who wrote on microscopic studies of tubal pregnancy. Dr R. M. Rawls' paper on the "Intra-uterine Stem Pessary" reawakens interest in a means of treatment which many gynæcologists have deemed defunct. The volume is full of interest.

The 38th volume of *Transactions of the American Surgical Association* for 1920, edited by John H. Jopson (Wm. J. Doran, Philadelphia), contains a large number of valuable articles covering a wide range of subjects. Acute and Chronic Empyema and the Surgery of the Thyroid receive special consideration.

Notes on Books

Papers from the Mayo Foundation (W. B. Saunders Company) is a series of contributions, mostly in abstract, made by junior members of the Mayo Clinic and of the Medical School of the University of Minnesota between 1915 and 1920. Most of the papers are based upon graduation theses, and the collection bears ample testimony to the vitality and enterprise of the university from which they emanate. Sixty-four workers contribute to the volume, which is the first of a series adumbrated. The able editor of the Mayo Clinic publications—Mrs Maud H. Mellish—is responsible for this compilation. We heartily welcome it, and look forward with pleasure to the succeeding volumes.

Volume 42 of the *Transactions of the College of Physicians of Philadelphia* contains the papers, many of them of exceptional interest, read before the College during the year 1920.

NOTES

Sir John Macpherson.

Dr John Macpherson, C.B., who lately retired from the post of Commissioner of the Board of Control for Scotland, has received the honour of knighthood. Sir John has been offered through the Agent-General of New South Wales, and has accepted for a period of three years, the post of Professor of Psychiatry in the University of Sydney. This Chair is the first of its kind in any University in Australia. The University Authorities were particularly anxious to appoint to this post a physician of authority and of experience, and it is a compliment to the Edinburgh School that they have selected one who is so closely connected with it. Dr Macpherson for some years lectured on the subject of Mental Diseases at the Royal Colleges' School of Medicine. His clinical knowledge was acquired at the Royal Hospital at Morningside and at the Stirling District Asylum. Few have had such experience as he in administration. There is already a clinic on Mental Diseases in connection with the hospital at Sydney, and it is expected that Prof. Macpherson will bring the teaching and other arrangements abreast of the latest advances that have been made in the science and practice of Psychiatry.

Royal College of Physicians, Edinburgh.

A Quarterly Meeting of the Royal College of Physicians of Edinburgh was held in the Physicians' Hall on 2nd May, Sir Robert Philip, President, in the Chair. Dr Alexander Gibson Henderson was admitted a Fellow of the College. Drs George Williamson, Alan Leonard Smith Tuke, M.C., James Bertie Simpson, O.B.E., D.L.,

David Huskie, John Johnstone Wilson, William Edward Foggie, D.S.O., were admitted Members of the College. The Lister Fellowship of the value of £100 was awarded to Dr Hedley Duncan Wright. Sir Joseph Fayrer, Bart., on behalf of the Officers of the 2nd Scottish General Hospital, presented to the College a silver bowl in commemoration of the services rendered by its Fellows during the Great War. Dr Thomas W. Dewar presented to the College an apothecary's balance, which had been the property of Prince Charlie. The College unanimously resolved to offer its Honorary Fellowship to Professor Albert Calmette of the Pasteur Institute, Paris, on account of his distinguished services to Medical Science.

Royal College of Surgeons of Edinburgh.

At the Meeting of the College held on 19th May, Sir David Wallace, C.M.G., President, in the Chair, Lieut.-Colonel Sir Joseph Fayrer, Bart., on behalf of the Officers of the 2nd Scottish General Hospital, presented to the College a silver bowl as a memento and a permanent record of the services rendered by its Fellows during the Great War.

At the same Meeting, the sixteen successful candidates out of forty seven entered, who passed the requisite examinations in January 1922, were admitted Fellows:—Henry Norman Bethune, M.B. Toronto; Ralph Burn Boston, M.B., Ch.B. Edin.; Edward Demetrius Dalziel Dickson, M.B., Ch.B. Edin.; May Edith Glancey, L.M. & S. Bombay; L.R.C.S. Edin.; Laurence Walrond Innes, M.B., Ch.B. Edin.; David Anderson Laird, M.B., Ch.B. Edin.; Shu Fan Lee, L.M.S. Hong Kong Medical College, M.B., Ch.B., D.T.M. & H. Edin.; Douglas Alexander Miller, M.B., Ch.B. Edin.; Koyikal P. R. Pillai, M.B., B.S. Madras; Stephen Horatio Pugh, M.B., Ch.B. Edin.; Thomas Heyliger Richmond, M.B., Ch.B. Glasg.; Bolar Thangamma, L.M. & S. Madras, L.R.C.S. Edin.; Eric Watson-Williams, M.R.C.S. Eng.; M.B., B.C. Cantab; Laurence Algernon Wilson, M.B., B.S. Adelaide; Owen Wilson, M.B., Ch.B., B.A.O. Belfast; James Matthew Wishart, M.B., Ch.B. Edin.

The Bathgate Memorial Prize consisting of Bronze Medal and Microscope was, after a competitive examination in Materia Medica, awarded to Mrs Grace Laubscher, Edinburgh, and the Ivison Macadam Memorial Prize in Chemistry consisting of Bronze Medal and Set of Books was awarded, after competitive examination, to Mr Douglas Barron Cruickshank, Edinburgh.

The following candidates, having passed the requisite examinations, received the Higher Dental Diploma:—Norbert Ryland Whitaker, L.R.C.S.E. (Triple), L.D.S., R.C.S. Edin.; Robert Charles Scott Dow, L.R.C.S.E. (Triple), L.D.S., R.C.S. Edin.; George Herbert Webb, L.D.S. Leeds, Halifax; and George Parker, L.D.S., R.C.S. Eng.

BOOKS RECEIVED

BARDSWELL, NOEL D., Edited by. A Tuberculosis Clinic (*John Bale, Sons, & Danielsson, Ltd.*) 6s.

BYAM, W., and R. G. ARCHIBALD, Edited by. The Practice of Medicine in the Tropics. Vol. II. . . . (*Oxford Medical Publications*) £4, 4s.

COBB, IVO GEIKIE. Aid to Organotherapy. (*Baillière, Tindall & Cox*) 5s.

COMRIE, JOHN D. Selected Works of Thomas Sydenham, M.D. (*John Bale, Sons, & Danielsson, Ltd.*) 8s. 6d.

CROOKSHANK, F. G., Edited by. Influenza: Essays by Several Authors (*Wm. Heinemann (Medical Books), Ltd.*) 30s.

DANYSZ, J. Translated by Francis M. Rackemann. The Evolution of Disease . . . . . (*Lea & Febiger*) $2·75

DICK, J. LAWSON. Rickets . (*Wm. Heinemann (Medical Books), Ltd.*) 20s.

DIXON, HENRY H. Practical Plant Biology (*Longmans, Green & Co.*) 6s.

GILCHRIST, J. D. F., and C. VON BONDE. Practical Zoology (*E. & S. Livingstone*) 15s.

GOULD, ERIC PEARCE. Surgical Pathology (*J. & A. Churchill*) 6s.

GUY'S HOSPITAL REPORTS. Vol. 72, No. 2, April 1922 (*Henry Frowde and Hodder & Stoughton*)

HANDLEY, W. SAMPSON. Cancer of the Breast. Second Edition (*John Murray*) 30s.

HOLT, L. EMMETT, and JOHN HOWLAND. The Diseases of Infancy and Childhood. Eighth Edition . . . . (*D. Appleton & Co.*) 35s.

KANAVEL, ALLEN B. Infections of the Hand. Fourth Edition (*Lea & Febiger*) $5·50

LABBÉ, MARCEL. A Clinical Treatise on Diabetes Mellitus (*Wm. Heinemann (Medical Books), Ltd.*) 18s.

MAGIAN, A. C. Sex Problems in Women (*Wm. Heinemann (Medical Books), Ltd.*) 12s. 6d.

MANN, J. DIXON, and WILLIAM A. BREND. Forensic Medicine and Toxicology. Sixth Edition . . (*Charles Griffin & Co., Ltd.*) 30s.

PLIMMER, VIOLET G., and R. H. A. PLIMMER. Vitamins and the Choice of Food . . . . . (*Longmans, Green & Co.*) 7s. 6d.

PORTER, LANGLEY, and WILLIAM E. CARTER. Management of the Sick Infant . . . . . (*Henry Kimpton*) 42s.

POTTINGER, FRANCIS MARION. Clinical Tuberculosis. In two vols. Second Edition . . . . . (*Henry Kimpton*) 75s.

RANDALL, PHILIP N. Experience and True Temperance (*The Anti-Prohibition League*) 1s.

ROBERTSON, W. G. AITCHISON. The Student's Guide to Vaccination (*A. & C. Black, Ltd.*) 3s. 6d.

REED, CHARLES J. The Law of Vital Transfusion and the Phenomenon of Consciousness . . . . (*Occidental Publishing Company*)

SAINSBURY, HARRINGTON. The Heart as a Power Chamber (*Oxford Medical Publications*) 12s. 6d.

THE GLAXO BABY BOOK. Fourteenth Edition (*Joseph Nathan & Co., Ltd.*) 1s. 2d.

TRANSACTIONS OF THE AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS. Vol. XIV. 1921

VOLTZ, FRIEDRICH, Edited by Reginald Morton. Dosage Tables for Deep-Therapy . . . (*Wm. Heinemann (Medical Books), Ltd.*) 10s. 6d.

Edinburgh Medical Journal

August 1922

THE URETHROSCOPE AS AN AID IN THE DIAGNOSIS AND TREATMENT OF GONORRHŒA.*

By CECIL C. BROWN, M.D., D.P.H., Assistant Clinical Venereal Diseases Officer to the Corporation of Edinburgh.

AT the present time the urethroscope is as essential in the diagnosis and treatment of gonorrhœa as the stethoscope is in cases of disease of the chest. In many cases of urethritis success in treatment can be achieved without its use, but in a very wide margin of cases urethroscopic examination is necessary to establish a complete and permanent cure.

Examples of so-called "relapse cases" are frequently seen where the treatment of the original infection has been restricted to irrigations, sometimes with prostatic massage and vaccines, without, however, a urethroscopic examination prior to their being discharged as cured. Had urethroscopy been undertaken these relapses need never have occurred, for the condition responsible for the relapse would have been discovered and with appropriate treatment cured. It stands to reason that by inspecting the urethra directly through the urethroscope, the surgeon will acquire a much more intimate and detailed knowledge of its condition than he can ever hope to gain by any other means.

Hughes points out that in the Naval Barracks at Portsmouth in 1917-18, "After the introduction of the urethroscope, the incidence of gonorrhœa fell between 40 and 45 per cent., and this fall was entirely due to the disappearance of 'relapse cases.'"

Varieties of Modern Instruments.—A urethroscopic examination is confined, in the great majority of cases, to the anterior urethra. Many designs of instrument are now available,

* Abstract of a Thesis for the Degree of Doctor of Medicine, University of Edinburgh.

differing, as a rule, only in points of detail. The light is supplied by an electric lamp run from a dry battery or transformer. The instrument consists of an open-ended tube and obturator, the lamp being carried on a long thin stem to the lower end of the tube, in the internal illumination urethroscope; while in the external illumination variety the lamp lies outside the sheath. The addition of a magnifying lens of correct focus gives a much more detailed view of the field. The writer's preference lies with the Holborn or Cambell Internal Illumination Urethroscopes, in both of which an air-bellows is attached, which permits of distension of the urethra, while under observation. Air distension gives the required information as to whether any part of the canal is dilating properly or not. This information is of the greatest importance.

Posterior urethroscopy is seldom required and only then in exceptional cases, as nearly all cases of posterior urethritis can be cured without its use. The reason for this is that the numerous prostatic tubules opening into the posterior urethra can be cleared of infection by massage of the prostate. If this is properly carried out there is little likelihood of any trouble arising in that part of the urethra. Occasionally, however, as in a case of recurrent epididymitis, it becomes necessary to examine the posterior urethra. A satisfactory view can be obtained with the irrigating urethroscope of Wossidlo or with Buerger's cysto-urethroscope.

The view of the field is of course indirect, and considerable experience is required before these instruments can be used with any degree of confidence.

Uses of the Urethroscope.—(*a*) The diagnosis of gonorrhœa in the acute stages is not, as a rule, a matter of much difficulty, but the position is quite the reverse when the acute manifestations have passed off.

It frequently happens that a patient will report for the first time some weeks after infection. He may have had no treatment whatever, or, as is frequently the case, has treated himself with Sandal-wood Oil Capsules or irrigated with Condy's Fluid. The only complaint is a "gleet" in the morning. On examination by the multiple glass test the urines are found to be clear, but the first contains some muco-purulent "threads." Urethroscopic examination shows that the infection is persisting in one or more of the follicles. In such a case the urethroscope makes it possible to diagnose and localise existing disease.

In addition it is also of great value in detecting lesions resulting from an old-standing gonococcal process, *e.g.*, the various stages of stricture. The method of diagnosing stricture by means of a bougie is antiquated. There is no point in trusting to the sense of touch when one can employ the sense of sight, especially as stricture is so frequently simulated by spasm. The association of stricture and spasm is more common than is generally supposed, and it is most certainly impossible to differentiate between these two conditions by means of a bougie. Apart from the common manifestations and sequelæ of gonorrhœa, urethroscopy enables a diagnosis to be made of the rarer conditions occasionally met with—for example, polypi and congenital abnormalities, such as diverticula.

(*b*) The success of the modern treatment of gonorrhœa is undoubtedly due in large measure to the urethroscope. The refinements in diagnosis which are now possible by its use have put the treatment of the disease and its complications on a rational basis. By accurate diagnosis the instrument not only suggests the appropriate treatment required, but enables the surgeon to gauge the amount of treatment indicated in each case. If, for example, a case shows evidence of early infiltration of the urethral mucosa, it will require instrumental treatment, preferably by Kollmann's dilator. This may be done on three occasions at intervals of seven to ten days. At the end of that time the next step is to examine the urethra once more by the urethroscope. If the infiltration has disappeared there is no indication for further treatment. If still present it will be possible to judge from the degree of improvement the amount of further treatment necessary.

In addition the urethroscope is a very efficient guide as to the relative values of various forms of therapy. In this connection, so far as the treatment of early infiltrates is concerned, the best and most efficacious remedy is undoubtedly Kollmann's irrigating dilator. Indeed, for the successful treatment of stricture at any stage, this instrument is absolutely indispensable. It is made in two forms, a straight four branch variety for the penile urethra and a curved variety for the bulbous urethra. By means of a screw the branches are made to open and each portion of the urethra is dilated to its proper calibre. In connection with the screw is a dial marked with a millimetre scale, which registers the degree of dilatation reached. The instrument is so designed as to allow a stream of warm lotion

to flow from behind forwards. This irrigating fluid softens the tissues and washes away the discharge from the glands; and the hyperæmia produced by the instrument brings about the gradual absorption of the fibrous tissue elements.

Indications.—A careful urethroscopic examination is necessary in every case of gonorrhœa, but it is essential to wait until all acute manifestations of the disease have subsided before this operation is undertaken. Tender points along the urethra, or complications such as prostatitis or epididymitis, in their acute or sub-acute forms, are definite contra-indications.

In general it may be said that urethroscopy is indicated in the chronic forms of urethritis, but in every case, prior to the use of the instrument, several points require investigation.

A careful examination of the urine by the multiple-glass test is an essential preliminary. The purpose of this test is to ascertain the presence or absence of acute inflammation, and, if present, its degree and site. As a general rule it is not wise to use the urethroscope in any given case until the urine is clear. The urine in the first glass may contain "threads," but if otherwise clear this need not be regarded as a contra-indication.

It is always wise in cases where there is a history of frequent relapses to postpone the examination, as in such cases active or easily excited foci are present which urethroscopy would tend to provoke.

To use the urethroscope at random without a proper examination of each case does more harm than good, and merely brings the instrument into disrepute.

The importance of waiting until all the acute stages of the disease have passed off lies in the fact that the instrument, when introduced even with the greatest care, necessarily causes a certain amount of irritation. Normally the mucous membrane of the urethra is extremely sensitive, but after an acute infection is much more so. An acute relapse therefore is a not uncommon sequel to urethroscopy in cases where the above points have been disregarded.

The contra-indications to the use of the urethroscope are—acute stages or symptoms of the disease; a history of frequent acute relapses; complications in their active or sub-acute forms; and certain anatomical defects, such as small meatus.

Preparation of the Patient.—An essential preliminary to urethroscopy is an examination of the meatus. While in the

great bulk of cases there is no difficulty in passing at least a moderate-sized urethroscopic tube, in a few cases the meatus requires to be enlarged. This difficulty of small meatus can as a rule be surmounted by dilating the opening with straight bougies. There is no need to pass these bougies completely, an inch or so is sufficient.

If this procedure should cause too much discomfort to the patient, the only alternative is to perform a meatotomy. This will entail postponing urethroscopy for a few days until the wound heals, but there should then be no difficulty in passing a tube of considerable size. The larger the tube the more definite the diagnosis and the more satisfactory the treatment. The patient should be instructed to retain his urine for at least two hours as urination washes away any discharge.

The immediate preparation of the patient includes removal of the clothing below the waist in order to expose the genital organs. He should then be instructed to lie flat on the operating table. A perforated square of mackintosh is placed over the genitals, leaving only the penis exposed. After the glans penis and meatus have been thoroughly cleansed with spirit, the preparation of the patient is complete.

Introduction of the Urethroscope.—The introduction of the anterior urethroscope is a very simple procedure. The patient is prepared as described, and the operator stands at the patient's right side. The penis is grasped with the left hand, and the urethroscope, having been lubricated with boroglyceride or paraffin, is passed into the urethra. Force should never be applied. On the contrary, the instrument should be allowed to slide vertically into the canal by its own weight. This is a point, the importance of which cannot be over-emphasised. The collar formed by the junction of obturator and sheath is very liable to injure the mucosa and cause hæmorrhage unless every care is taken. When the sheath has been fully passed the obturator is withdrawn and the lubricant removed from the interior of the tube by sterile cotton-wool swabs. The lamp is then introduced and the eye-piece fixed in position. It is best to use no more light than is necessary to give a satisfactory illumination of the field. Too powerful a light is dazzling to the eyes of the operator. The urethra can now be examined from the compressor urethræ muscle to the meatus. In such an examination attention will be directed to the lustre of the urethra; the condition of the follicles and lacunæ; the presence

or absence of infiltrates or new growths; and to the degree of elasticity of the walls as tested by air-distension.

The introduction of the posterior urethroscope is a rather more intricate proceeding. The patient is prepared as for anterior urethroscopy, but before introducing the instrument it is advisable to instil a little novocain into the deep urethra. As in passing the sound, four manipulations are used. Gravitation is first, and consists in allowing the instrument to slide vertically down to the bulb under its own weight. Elevation comprises supporting the beak of the instrument against the pubic arch so as to lift it out of the bulb. This is a step that can be assisted by the finger in the rectum. Depression consists in carrying the eye-piece downwards while the beak rotates under the arch of the pubis. Penetration is the last step. For this the finger in the rectum should be passed to the apex of the prostate. The instrument is then slid along the finger to the neck of the bladder. A little gentle pressure against the vesicle sphincter carries the instrument into the bladder. If urine flows out on withdrawing the obturator the sheath should be withdrawn slightly. The light is then inserted and the eye-piece focussed. The use of an instrument which allows of irrigation and dilatation with water is an undoubted advantage, as exudate can be removed and the normal arrangement of the mucosa maintained.

The Use of Styptics and Anæsthetics. — Urethroscopy properly performed is a painless operation. Occasionally it gives rise to a slight feeling of discomfort, but the examination should never cause actual physical suffering. Anæsthetics therefore play a very insignificant part in ordinary routine work, the only cases requiring local anæsthesia being those in which the patient is very nervous or the urethra hypersensitive.

In operative work anæsthesia is of great value; novocain in ½ to 2 per cent. strength is very efficient. In the case of narrow strictures where difficulty is experienced in passing a bougie, it is a good plan to instil novocain into the urethra as stricture and spasm are frequently associated and spasm relaxes under anæsthesia. In a few cases the so-called stricture disappears entirely after the application of novocain, and there is then no difficulty in passing large-size bougies. It is in operative work also that styptics are of greatest value. Bleeding naturally obscures the field, and adrenalin is extremely useful in controlling it. For all ordinary work astringents should be avoided

as far as possible, as the vaso-constriction produced is apt to simulate an infiltration very closely, and thus be misleading.

The Normal Appearance of the Urethra.—In appearance the normal urethra varies very considerably throughout its course, and there is also a certain degree of variation within the normal in different individuals.

(a) *Glandular Portion.*—This section is golden yellow in colour. The wall is of tough consistence, and only dilates to a slight degree under air-distention. The striations which are a typical feature of the adjacent portion of the urethra are almost entirely absent. Situated about an inch from the meatus is a large gland, practically constant in position—the lacuna magna, the free edge of the lacuna being known as the valve of Guerin. The absence of folds in the fossa navicularis is due to the mucosa being firmly supported by the body of the glans.

(b) *Pre-bulbar Portion.*—The mucosa at this part provides a striking contrast to the glandular portion. It is bright red in colour, moist, glossy, and very vascular. The presence of striations is a characteristic and well-marked feature, and when examined without air-distension they are seen radiating to the periphery from the "central point," where the mucosa falls together giving the impression of spokes radiating from the "hub" of a wheel. The blood vessels serve to accentuate the striations. The number of folds depends to some extent on the individual and on the size of the sheath used. Under air-distension the folds are largely lost.

Throughout this portion are numerous glands and lacunæ. The former, the glands of Littré, are situated chiefly in the roof, and are best seen under air-distension. In some cases they are almost invisible to the normal state, but usually they can be made out as a faint single or double row of points dotted along the roof. This distribution is practically constant. Occasionally there are a few scattered glands on the sides and floor of the urethra.

The lacunæ of Morgagni are also situated on the roof of the urethra in the middle line, but they rapidly diminish in number towards the bulb, in contrast to Littré's glands, which are more numerous in that region. These lacunæ are simply V-shaped diverticula, having their openings directed towards the meatus. In health they are not very distinct, but as one or more of Littré's glands may open into them it can be readily

understood that they are very liable to become the seat of chronic infection. Fortunately, in the urethroscope the urologist possesses an instrument which can demonstrate very definitely the presence of inflammation in either glands or lacunæ.

(c) *Bulb.*—The mucosa is deeper in colour at this part, owing to increased vascularity. This fact renders it imperative to employ great care in manipulating the instrument, otherwise hæmorrhage is liable to occur. The folds are more voluminous, and under air pressure the compressor urethræ muscle can be seen alternately contracting and relaxing, while the floor of the urethra passes upwards and backwards out of view. The mouths of the ducts of Cowper's glands can seldom be distinguished clearly in health.

(d) *Membranous Urethra.*—The fasiculæ of the compressor urethræ muscle throw the mucous membrane into numerous regular folds. Gland structures are comparatively few in number and difficult to locate in health.

(e) *Posterior Urethra.*—The floor is the most important part and is characterised by a projection—the verumontanum rising from its surface. The prostatic ducts open on either side of the verumontanum. When viewed through an irrigating urethroscope the mucosa appears paler than it really is, owing to the pressure exerted by the irrigating fluid. At this part the mucous membrane is very delicate and hæmorrhage is easily provoked. The surface of the verumontanum is smooth and uniform in colour, and as a rule the ejaculatory ducts open on it, one on either side.

This part should be specially examined for the presence of cysts, or polypi.

The utriculus is a small blind depression embodied in the verumontanum and frequently seen in the centre. If the utriculus is gaping, the procedure adopted by some urologists is to inject it with some silver solution or electrargol by means of a Geraghty syringe. Should it be infected, gonococci will be demonstrable in the discharge produced.

(f) *Vesical Neck.*—At the junction of bladder and urethra the mucosa is deep red in colour and is drawn up into deep longitudinal folds by the vesical sphincter. In colour it contrasts very strongly with the golden-yellow mucosa of the bladder.

Pathological Appearances.—(a) *Acute Lesions.*—In the early acute stages of gonorrhœa, when it is still an anterior urethritis,

the inflammation is limited to the surface of the mucosa. By the time the great majority of cases come for treatment, however, the inflammatory process has spread deeper and the submucous tissues become infiltrated with round cells. The process spreads rapidly backwards, and the bulbous urethra, where the inflammatory changes are usually most severe, is soon involved. As usually happens, the posterior urethra becomes infected and similar changes take place there. The glands and follicles readily become infected with varying results. They may discharge infective material on the surface or the gland openings may become occluded and the organisms remain blocked up inside. For the diagnosis of such a condition it is obviously no use relying on ordinary methods of examination, as the patient may exhibit no clinical signs whatever of disease. The only rational course to adopt, therefore, is to examine the mucosa with the urethroscope and learn definitely whether the follicles are infected or not. In a case of folliculitis the mouths of Littré's glands will be seen to be pouting with a red area surrounding and frequently a tiny yellow bead of pus at the openings. These follicles discharge their contents on the surface of the mucosa intermittently, so that the patient is constantly hovering between apparent cure and relapse. It is not uncommon to meet a patient who will give a history of several such relapses. So far as treatment is concerned it is useless to rely on irrigations to cure cases of folliculitis, as the irrigating fluid never reaches the seat of the trouble. The proper treatment is to encourage the emptying of the infected glands. This can be done by means of Kollmann's irrigating dilator, which, by stretching the urethra, widens the mouths of the follicles and enables the antiseptic fluid to wash out the plugs of secretion. Another excellent method of treating such cases is to extract the contents of the glands by suction with Mill's negative pressure catheter and suction-ball. The effect of such treatment and the progress of each case can, of course, be appreciated by urethroscopy at suitable intervals until cure is established.

In the following cases, which illustrate several of the points raised, in addition to urethroscopy as a test of cure, bacteriological and other methods were adopted prior to this final test. The majority of patients have since reported and been found free from all symptoms.

Case I.—In this case the persistence of the acute symptoms and the relapse was due to the discharge of infected material by the follicles on the mucosa.

17.2.21. History—First attack. Patient reported at the Clinic with acute discharge; treated with vaccines and daily irrigations; eight weeks elapsed before acute symptoms disappeared.

16.4.21. Urines—(1) Clear, with threads; (2) clear. Put on bi-weekly irrigation; three days later reported with profuse discharge. Again put on daily irrigation.

23.5.21. Urines—(1) Clear, with threads; (2) clear.

24.5.21. Urethroscoped—"Mucosa granular with definite inflammation of follicles. Some discharging pus." Suction treatment applied on four occasions at four-day intervals.

23.6.21. Urines—(1) Clear; (2) clear.

24.6.21. Scoped—"Mucosa healthy. No evidence of folliculitis." Discharged cured.

Case II.—History—First attack. Incubation, seven days; duration of treatment, eight weeks.

26.7.21. Urines—(1) Clear—large numbers of muco-purulent filaments; (2) clear.

27.7.21. Scoped—Found to be a case of severe folliculitis; the glands were inflamed and distended, one or two discharging pus.

28.7.21. Kollmann's dilator 40.

5.8.21. Suctioned.

12.8.21. Suctioned. Urines—(1) Clear, with threads; (2) clear.

26.8.21. Kollmann's dilator 40. Urines—(1) Clear; (2) clear.

30.8.21. Suctioned. Urines—(1) Clear; (2) clear.

21.9.21. Urethroscopic examination showed the condition to be very greatly improved. None of the follicles were discharging, and only one or two showed faint rings of hyperæmia. Still under treatment.

Case III.—In this case of non-gonococcal urethritis the whole trouble was traced to two follicles infected by secondary organisms.

History—First attack. Incubation eighteen days; discharge practically nil. Repeated examination of smears failed to detect gonococci though abundant secondary organisms were present. Patient had been treated for several months at another Clinic. Complained of persistent slight mucoid discharge.

21.1.21. Scoped—Two congested follicles seen in penile urethra—one distinctly discharging pus. Urines—(1) Clear, with threads; (2) clear.

25.1.21. Suctioned.

1.2.21. „

4.2.21. Suctioned.
8.2.21. „ Urines—(1) Clear; (2) clear.
15.2.21. „ Urines—(1) Clear; (2) clear.
17.2.21. Scoped—Follicles now seen to be perfectly healthy; both urines absolutely clear.
Discharged cured.

Case IV.—History—Second attack. Incubation, eight days. Treated for some weeks by his own doctor with irrigations. Complaint—Persistent mucoid discharge.

26.8.21. Urines—(1) Clear, with threads; (2) clear.
28.8.21. Scoped—Very definite inflammation of glands in roof.
2.9.21. Suctioned.
7.9.21. Kollmann 30.
12.9.21. Suctioned.
16.9.21. Kollmann 32. Urines—(1) Clear; (2) clear.
21.9.21. Scoped—Follicles healthy.
Discharged cured.

Case V.—The following case, though not one of folliculitis, may suitably be mentioned here. This case was remarkable in that there were absolutely no symptoms or signs by which the abscess could be located. On suitable drainage the discharge cleared up. Gonococci were never discovered in any of the numerous smears taken.

History—Reported with syphilitic infection on 8.7.20. Profuse purulent discharge from under foreskin. Syringing under foreskin and irrigations of no avail.

27.7.20. Circumcised. Pus pouring from meatus. No evidence of abscess in perineum or in the pubic region. Examination per rectum, negative. Put on vaccines. As patient was in a precarious condition it was decided to perform urethroscopy.
22.8.20. Urethra and bladder washed out with boric lotion. Scoped—mucosa congested; no pus seen coming from the follicles; striations well defined; urethra dilates well. On withdrawing tube to fossa navicularis, pus seen pouring from a small sinus. Probe introduced and passed along corpus spongiosum to the pubic region.

(b) *Sub-acute Lesions.*—After a period usually varying from two to three weeks the acute process dies down, and in favourable cases the round-cell infiltration of the sub-mucous tissues is removed. In others the inflammatory process progresses and the sub-mucous tissues become densely packed with round cells, the precursors of fibrous tissue. There is usually an associated folliculitis.

The folds become coarse and bulging, but in the early stages can be easily distended under air-pressure, showing that the infiltration is not yet sufficiently far advanced to diminish the elasticity of the mucosa. The urethra at the affected part is seen to be dull red in colour, and the striations are lost. Bleeding is easily provoked owing to the increased vascularity.

If this condition of "soft infiltration" or "soft stricture" be allowed to progress without appropriate treatment, the next step is the formation of fibrous tissue. As a result the flexibility of the mucosa is diminished, and the walls of the urethra, as seen under air-inflation, expand and relax sluggishly. This transition stage is frequently suspected on passing the urethroscope, as the tube can be felt to be "gripped" during its introduction.

Case VI.—History—First attack. Incubation, four days. Treated with irrigations and vaccines. Discharge almost clear when patient had an accident, which prevented treatment for four weeks. On his return no evidence of discharge.

2.4.21. Urines—(1) Clear, with threads; (2) clear.
5.4.21. Scoped—Very definite soft infiltration seen in mid-penile urethra. The follicles were prominent and inflamed, but not discharging.
7.4.21. Kollmann 39.
11.4.21. Suctioned.
16.4.21. Kollmann 42. Urines—(1) Clear; (2) clear.
23.4.21. Suctioned.
12.5.21. Scoped—No evidence of infiltration or other lesion. Discharged cured.

Case VII.—History—First attack. Incubation, two days; intermittent discharge for three months.

14.7.21. Urines—(1) Clear, with muco-purulent threads; (2) clear.
16.7.21. Scoped—Mucosa in mid-penile urethra inflamed and bulging; striations lost; extensive folliculitis present.
18.7.21. Kollmann 32.
20.7.21. Suctioned.
25.7.21. Kollmann 32.
10.8.21. Suctioned.
19.8.21. Suctioned.
23.8.21. Kollmann 34.
8.9.21. Urines—(1) Clear, with few filmy threads; (2) clear.
10.9.21. Scoped—Few follicles show slight congestion; otherwise infiltration has disappeared.
Still under treatment.

Case VIII. — History — Infection eighteen months previous. Treated privately with irrigations, vaccines, and prostatic massage. Complaint—Persistent gleet; prostate negative.

24.2.21. Urine—(1) Clear, with threads; (2) clear. Scoped—Very definite infiltration of transitional type seen along dorsum urethræ; tender when pressed gently; dilates sluggishly at that part. No evidence of folliculitis.
1.3.21. Kollmann 32.
6.3.21. Kollmann 34.
12.3.21. Patient states gleet now absent. Urines—(1) Clear; (2) clear.
16.3.21. Kollmann 34.
26.3.21. Scoped—Everything satisfactory; no trace of infiltration.

Case IX. — History — Second attack. Incubation, two days; duration, five weeks. Prostate negative.

22.2.21. Urines—(1) Clear; (2) clear.
24.2.21. Scoped — Infiltration of transitional type seen in penile urethra; mucosa inflates sluggishly and incompletely.
26.2.21. Straight bougies up to 10/14.
5.3.21. Kollmann 30.
10.3.21. Straight bougies up to 10/14.
18.3.21. Kollmann 34.
26.3.21. Straight bougies up to 10/14.
9.4.21. Kollmann 37.
16.4.21. Scoped—Mucosa healthy; no evidence of infiltration; dilates well.
Discharged cured.

(c) *Chronic Lesions.*—In course of time a soft infiltration becomes converted into a hard infiltration as a result of the development of the fibrous-tissue-forming elements. As scar tissue is formed the colour of the infiltrate changes from the deep red of the early lesion to grey, owing to the gradual constriction of the blood-vessels by the newly-formed tissue.

The resiliency of the urethra is impaired to a varying degree, depending on the extent of the invasion of the submucous coat by fibrous tissue. This is well seen under air-distension. In extreme cases the lumen of the urethra remains like a funnel during withdrawal of the instrument and no folds are to be seen.

(d) *Stricture* is the extreme degree of hard infiltration, and the urethroscopic picture of it is unmistakable. The calibre of a stricture should always be determined by air-distension. This affords information not only with regard to the form of

treatment necessary, but also with regard to the size of instrument it will be possible to start with in dilating the stricture.

The writer prefers Kidd's classification of the various types of fibrous stricture according to the extent of the lesion.

(1) The simplest type consists of a small crescent of fibrous tissue involving perhaps a quarter of the circumference of the canal. As a rule this lesion is associated with a long-standing inflammation of one of Littré's glands.

(2) The next type is the so-called "bridle-stricture," where the crescent involves about two-thirds of the canal.

(3) The third type involves the whole circumference of the canal and is seen as a circular fibrous band. The lumen in the early stages is large, but subsequent contraction reduces it to pin-point dimensions.

(4) The fourth type is the most difficult to treat, as it arises from an extensive sub-mucous infiltration, which in time produces a tunnel of fibrous tissue frequently tortuous in its course. This thickened cylinder of fibrous tissue can usually be palpated from the outside as well as seen.

The aim in the treatment of strictures should be to dilate the urethra by bougies, metal or gum-elastic as the case demands, until it is possible to introduce Kollmann's dilator. It is no exaggeration to say that this instrument is the most efficacious in the treatment of stricture, for by means of it a stricture can be over-dilated until it ceases to recur. It succeeds in effecting a permanent cure in very many cases where the old treatment by bougies fails.

Case X.—History—Second attack. Gonorrhœa 1919, duration six weeks. Scoped—"Mucosa lustrous and of good colour, except at point 2 inches from meatus, where there is crescent-like stricture involving one-third of urethra; dilates poorly; no folliculitis." Straight bougies were passed twice and then Kollmann's dilator used on five occasions.

19.4.21. Scoped—"Mucosa healthy; no evidence of stricture."
Discharged cured.

Case XI.—History—Infection 1914; treated with irrigations. Complaint—Slight gleet.

30.3.20. Scoped—"Bridle stricture in deep part of penile urethra. Tube cannot be passed through it. Dilates poorly."
6.4.20. Béniqué 17 passed.
13.4.20. ,, 17 to 20 passed.
26.4.20. ,, 18 to 21 ,,
4.5.20. ,, 19 to 23 ,,

11.5.20. Kollmann 30.
26.5.20. „ 32.
1.6.20. „ 35.
4.6.20. Scoped—"Mucosa dilates almost normally."
6.6.20. Kollmann 35.
12.6.20. „ 36.
20.6.20. Scoped—"Urethra healthy and lustrous; no evidence of stricture; dilates well throughout."
Discharged cured.

Case XII.—History—Gonorrhœa three years ago and eighteen years ago. Treated for stricture for fifteen years.
16.5.21. Urines—(1) Hazy; (2) slight haze. Hexamine and Acid Soda Phos. prescribed.
21.5.21. Scoped—"Tight circular stricture well seen at proximal end of bulbous urethra. Urethra anterior to stricture granular and bleeds easily." Stricture gradually dilated with gum-elastic bougies and then with Béniqués.
26.7.21. Béniqué 21 to 23 passed. Urines—(1) Clear; (2) clear. Case now being treated with Kollmann's dilator.

Case XIII. — History — Gonorrhœa 1919. Complaint — Urine dribbling.
30.9.20. Urines—(1) Hazy; (2) hazy. Scoped—"Stricture present in fossa navicularis; also triangular-shaped stricture in mid-penile urethra. Unable to pass urethroscope beyond this." The case was treated in hospital for a time, and the strictures gradually dilated with straight bougies. On the first few occasions bleeding was profuse; dribbling continued for three months.
29.2.21. Scoped—"Two strictures seen, one mid-penile region, and one beginning of bulbous urethra. At these places mucosa is pale and dilates poorly. No bleeding, but field obscured by urine. Patient states much better control over urine." Strictures were then dilated with Béniqué bougies at intervals.
8.9.21. Scoped—"Mucosa very greatly improved; dilates fairly well." The urethra is now being over-dilated with Kollmann's dilator to prevent recurrence of the strictures. Perfect control over urine.

Case XIV.—The following case illustrates how stricture may be simulated by spasm:—
6.1.21. History—First attack; duration, six months. Treated privately with irrigations.
12.1.21. Scoped—"Mucosa very congested; striations not well marked; dilates well; numerous follicles discharging." Patient was treated for this condition for about eight weeks. He then

complained of great difficulty in passing water at certain times, while at others there was no difficulty.

3.3.21. Scoped—"Urethra at entrance to bulbous portion is seen in spasm. Lumen almost obliterated. Has not the appearance of fibrous stricture though pale." It was found impossible to pass even small gum-elastic bougies. Patient had a good stream, but the mere introduction of an instrument was always sufficient to cause spasm.

26.3.21. The bulbous urethra was anæsthetised with novocain introduced with an Ultzmann's syringe. There was then no difficulty in passing metal bougies of Béniqué type up to number 24. Bougies have been passed at intervals since, and there has been no recurrence of spasm.

The following two cases are examples of tunnel strictures :—

Case XV.—History—Gonorrhœa nineteen years before. Treated for stricture for twelve years.

4.12.20. Scoped—"Urethra leathery; bleeds readily; fibrous tissue scattered irregularly throughout urethra; canal twisted and much contracted; tube only partially passed."

This case required prolonged treatment with gum-elastic bougies before it was possible to pass metal instruments. On account of the twisting of the canal it is very doubtful if Kollmann's dilator will ever be passed.

Still under treatment.

Case XVI.—30.7.20. History—Patient, under the impression he had gonorrhœa, washed out his urethra with a concentrated solution of permanganate. Great pain and frequency; fossa navicularis eroded and corpus spongiosum infiltrated. Destruction of tissue very marked, and patient passed great shreds of mucous membrane.

When the acute inflammation had passed off the mucosa was almost entirely replaced by scar tissue. It was found impossible to pass the smallest size of gum-elastic bougie.

Under general anæsthetic the scope tube was introduced for about 1½ inches. The opening of the stricture was located and a fine gum-elastic bougie passed with difficulty.

Adrenalin was used to prevent hæmorrhage obscuring the field.

At the present time the stricture extends for fully three inches along the urethra, and can easily be felt as a thick hard fibrous band.

It is now possible to pass gum-elastic bougies of moderate size, but owing to the manner in which the fibrous tunnel is twisted it is very unlikely that any metal instrument will ever be able to be passed.

The patient suffers no inconvenience beyond some diminution of the flow of urine.

(*To be continued.*)

OBSERVATIONS ON THE ACTION OF QUINIDINE SULPHATE ON THREE CASES OF AURICULAR FIBRILLATION.

By W. M'L. WALWYN and J. S. FOWLER.

Introduction.—Within the past year a new remedy for auricular fibrillation, namely quinidine sulphate, has attracted some attention. In cases successfully treated with quinidine, the irregular rhythm of fibrillation gives place to a normal heart action. If symptoms of myocardial failure are present, the patient should be digitalised until compensation is re-established, whereafter quinidine is given. A course of quinidine ordinarily consists of 0·4 gram given three to five times daily until normal rhythm is established, or toxic symptoms appear. Such toxic symptoms are:—Temporary respiratory paralysis, headache, dizziness, sensation of fullness in the temples, ringing in the ears, slight blurring of vision, nausea, vomiting, embolism, abdominal pain, scarlatiniform rashes, profuse sweating, and pain in the back. As some patients are intolerant of quinidine, a preliminary dose of 0·2 gram is advisable. Intolerance shows itself a sudden failure of the respiration calling for artificial respiration and caffeine. The total amount of quinidine required and the duration of its administration would appear to be unsettled. Ellis and Clarke Kennedy[1] report a total dose of 25 grams over eighteen days, and one of the cases recorded below received 43·6 grams over thirty-seven days without bad effect of any kind whatever.

The nature of the action of quinidine is undetermined, but its beneficial effects are believed by Lewis[2] to be due to lengthening of the duration of the refractory period of the auricular muscle. To make it clear how such a lengthening may abolish fibrillation, it is necessary to refer to Lewis's theory of this disturbance of rhythm. According to his view,[3] the normal wave of contraction, which, starting at one point of a ring of muscle spreads along both arcs of the circle to meet at a spot opposite the point of origin, is replaced by a wave pursuing its course completely round the ring in one direction. To this abnormal course the name "Circus movement" is applied. The reason for the wave not being propagated equally along both arcs of the circle of muscle is supposed to be that one arc is weak, or diseased, and remains refractory longer than

its neighbour. Muscle which has just contracted is, as is well known, tired out (refractory phase), and if the wave of contraction is to continue to circulate there must always lie immediately in its path a segment of muscle which has recovered. If we can by any means replace this segment of recovered and therefore contractile muscle by muscle which is still tired out, the circus movement must necessarily come to an end. It is therefore obvious that if we can lengthen the duration of the refractory phase to such an extent that at any given point it is greater than the period required for one complete revolution, the impulse on arriving at its starting point will find its path blocked by a segment of muscle which is still refractory, and will be checked in its course. On the other hand, if the time required for recovery is less than the time required for one complete revolution of the wave, the impulse arriving at its starting point will find the muscle recovered, will be able to start on another such round, and thus the re-entering circus movement will continue indefinitely. If, therefore, auricular fibrillation is due to a circus movement of this nature, to lengthen the duration of the refractory period by quinidine is a rational means of restoring the normal rhythm. Further suggestions concerning the action of quinidine which have been made by White, Marvin, and Burwell,[4] need not be considered here. Whatever be the precise action of quinidine on the auricular muscle, the fact is now established that in many cases it changes an absolutely irregular rhythm into a perfectly normal one.

The following notes from case records are submitted as a contribution to our knowledge of the remedy :—

Case I.—*Summary.*—Post-influenzal auricular fibrillation of five weeks' duration, without serious myocardial failure, in a syphilitic subject. No previous cardiac symptoms. Reacted well to digitalis, pulse deficit disappearing in thirteen days. Normal rhythm returned immediately after administration of 2 grams of quinidine, and continues up till the time of writing, 3½ months later.

G. T., male, aged 42, for twenty-two years a stoker in the navy; for past year a clubmaster. Ten days before admission to hospital had taken suddenly ill with headache and vomiting, fever, cough with dark-coloured expectoration, and was sent in as a case of influenzal broncho-pneumonia. He had always been a healthy man, the only illness of note being typhoid fever in childhood. There have never previously been any cardiac symptoms; he lives in a flat up three

flights of stairs, and has never suffered from breathlessness, palpitation, dizziness, or œdema.

State on Admission.—Fairly nourished but not robust-looking man. Pallid and extremely prostrated. Physical signs of consolidation at the left base. No cyanosis, dyspnœa, or œdema. Pulse irregular in frequency and volume, averaging 80 per minute. Systolic pressure 100; diastolic 60. Heart somewhat enlarged to left (2 cm.), apex-beat diffuse and palpable in fifth interspace 10 cm. from mid-sternal line. Frequency 108 = pulse deficit 28. Sounds of lessened intensity, but murmurs absent. Wassermann strongly positive.

Treatment and Progress.—The signs in the chest cleared up satisfactorily in the course of a day or two. Upon admission he was put on tinct. digitalis, 15 minims thrice daily. For two weeks the pulse alternated between a regular and an irregular rhythm; on the thirteenth day after admission there was no pulse deficit, though the irregularity continued. Sixteenth day, polygraph tracing showed ventricular venous pulse. By the nineteenth day he had sufficiently recovered to allow of an electro-cardiogram being taken (Fig. 1), which

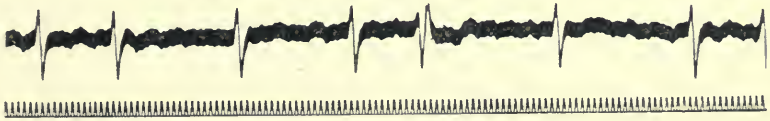


FIG. 1.—Before quinidine. Well-established fibrillation present.

confirmed auricular fibrillation with extra-systoles: auricular rate 306; ventricular 91. On twenty-third day of treatment 1 gram of quinidine sulphate was given, followed by the same dose next day. That evening polygraph tracing showed an auricular venous pulse, which was confirmed next (twenty-fifth) day by electro-cardiogram (Fig. 2). Digitalis stopped. Systolic pressure now 120; diastolic 70.

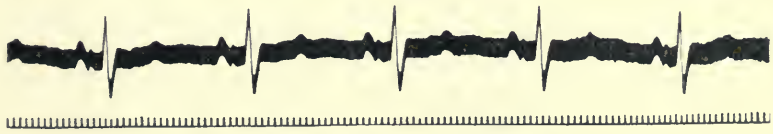


FIG. 2.—After quinidine. Normal rhythm.

Marked general improvement. Discharged from hospital on twenty-ninth day, by his own desire. He has reported at intervals of two weeks, when traces have confirmed the continuance of the normal rhythm. At the time of writing (fourteen weeks after discharge) he is in good health and is doing his ordinary work without any discomfort.

CASE II.—*Summary.*—Mitral incompetence, myocardial failure, and auricular fibrillation of at least one year's duration. Symptoms of decompensation abolished by 960 minims tinct. digitalis given over

fifteen days, but irregular rhythm and ventricular venous pulse persisted. *First Course* of quinidine (1.6 gram in two days) resulted in a more regular rhythm and the appearance of occasional *a* waves in the venous trace. *Second Course* of quinidine (2.4 grams in two days) produced a normal rhythm lasting five days, after which auricular fibrillation recurred. The period of normal rhythm was interrupted by occasional attacks of tachycardia. *Third Course* of quinidine (28.4 grams in nineteen days) produced normal rhythm and much general improvement. During this period fibrillation recurred when the daily dose was less than 1.2 gram. Four days after the cessation of this course there was again intermittent tachycardia, and in twelve days auricular fibrillation. *A Fourth Course* of quinidine (11.2 grams over fourteen days) produced a normal rhythm, which was maintained by a dose of 0.8 gram daily. This continued until the patient left hospital eleven days later. Total quinidine given, 43.6 grams.

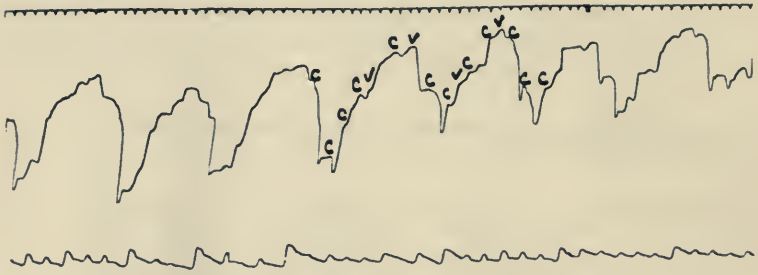


FIG. 3.—Before Treatment. Rate 120. No *a* waves.

A. F., female, aged 65, single, housewife. Father, mother, and one brother died of heart disease. Rheumatic fever at thirty years of age. Patient was quite well until ten years ago, when she became increasingly short of breath, and began to suffer from palpitation on exertion. One year ago she had an acute cardiac attack of pain, palpitation, and dyspnœa, by which she was confined to bed for six weeks, before she was well enough to resume her household duties. Since then she has suffered from more or less continuous praecordial pain. During the last few weeks she has been much worse and has become very short of breath.

State on Admission, 23rd January 1922.—Well-nourished woman, extreme dyspnœa amounting to orthopnœa. Slight œdema of one foot. Pulse absolutely irregular in volume and rhythm, rate 104, variable. Systolic blood pressure 104; diastolic could not be estimated. Arteries tortuous, walls thickened. Cardiac impulse diffuse, outside nipple line; no thrill. Left border 12 cm. from middle line in fifth space, right border 4 cm. in fourth space. First sound in mitral area sharply accentuated and tails off into a systolic

murmur, which is conducted outwards and is not heard nearer to the mid-sternal line than 8 cm. Liver 5 cm. below the costal margin in mammary line. Pulmonary œdema present with occasional blood-stained sputum. No ascites or cyanosis.

Treatment and Progress.—Polygraph tracing day after admission (Fig. 3) showed completely irregular jugular and radial pulses, rate 120, no *a* waves. On 25th January, 2 drachms tinct. digitalis daily begun; dyspnœa and œdema gradually disappeared. Fig. 4, after

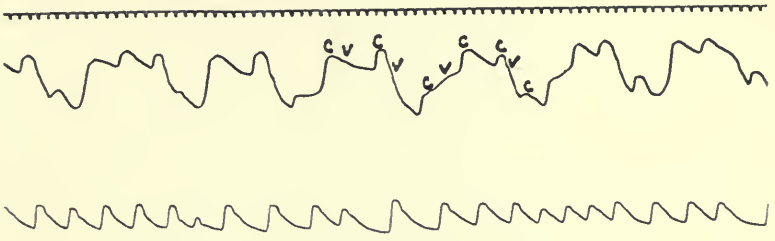


FIG. 4.—After administration of 750 minims tinct. digitalis. Pulse rate 68.

administration of 750 minims of tinct. digitalis shows an improvement in the radial pulse and absence of *a* waves from the jugular tracing. Digitalis was stopped on 7th February, the patient being much improved, and a first course of quinidine was given on this and the next day, commencing with 0.2 gram, and increasing to 0.4 gram doses, until 1.6 gram in all had been given. Fig. 5 shows the result; for the

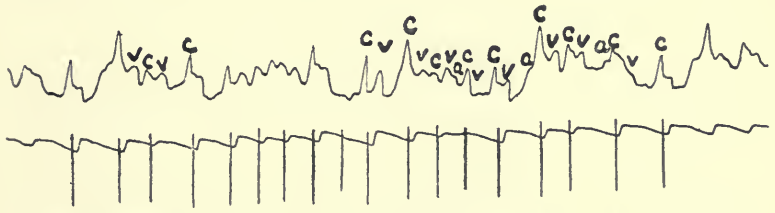


FIG. 5.—After 1.6 gram quinidine. Venous tracing shows *a* waves, though not constantly. Pulse rate 75.

first time an auricular venous pulse was obtained, though the *a* waves were occasionally absent. Radial pulse more regular than before. The condition remained unchanged until 13th February, when a second course of quinidine was given. On this and the next day 2.4 grams were administered in 0.4 gram doses. On the night of the 14th tachycardia began; frequency 136, perfectly regular for the first time (Fig. 6). The patient experienced no discomfort from the tachycardia, which continued all that night and the next day. On the 15th February the tachycardia became intermittent and alternated with

periods of normal rate. The changes from 140 to 70, and *vice versâ* took place quite suddenly, and without any subjective sensation whatever. On 19th February the pulse again became completely

FIG. 6.—After second course (2·4 grams) of quinidine. Tachycardia. Pulse rate 135.

irregular, and the tracing (Fig. 7) shows this as well as the absence of *a* waves.

A third course of quinidine (24.8 grams) in doses of 0.4 gram every six hours was begun on 22nd February. The radial and jugular pulses were completely irregular, and the polygraph tracing showed the same features as Fig. 7. No change occurred for two days, but at 7 P.M. on

FIG. 7.—Completely irregular pulse; auricular fibrillation. Pulse rate 91.

24th February the rhythm and force suddenly became regular, and a tracing taken then (Fig. 8) showed regular radial and jugular pulse,

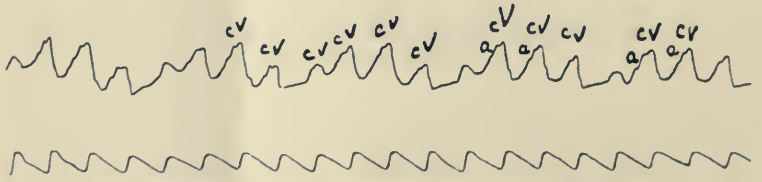


FIG. 8.—Normal rhythm after 3·2 grams quinidine (third course).

with presence of *a* waves. The quinidine was continued in the same doses, and on 27th February tachycardia (rate 140) appeared. Drachm doses of digitalis daily were given for three days, and the tachycardia stopped about twenty-four hours after its inception. The patient

continued to improve, and the regular rhythm was maintained. Quinidine was diminished to 0.4 gram twice daily on 5th March, and immediately the tachycardia (rate 120) returned. On the 6th March the doses were increased to three in the day, and the tachycardia was replaced by regular rhythm, rate 70. This dosage was continued until the 11th March, and during this period the normal rhythm continued at an average rate of 62 (Fig. 9). Cessation of the drug on the

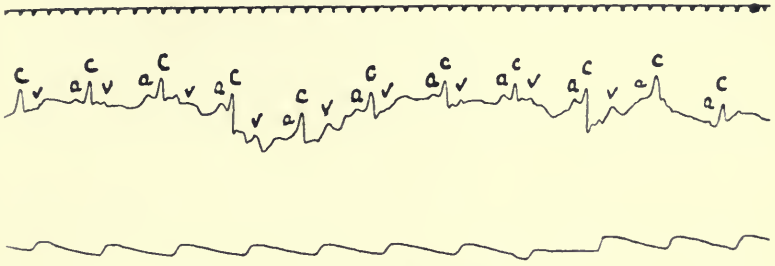


FIG. 9.—Normal rhythm continued.

11th was at once followed by a slightly irregular pulse, tracings showed spacing out between the beats, but each cycle complete though inconstant in duration (Fig. 10). On the 16th March there was

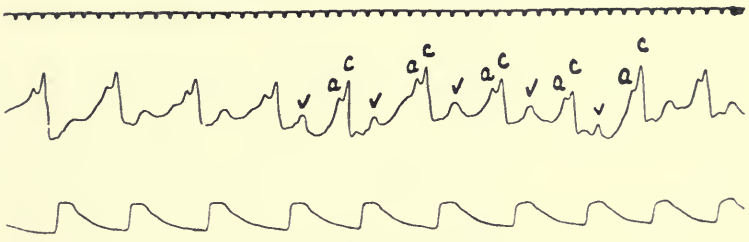


FIG. 10.—Commencing irregularity after cessation of quinidine. Pulse rate 60.

intermittent tachycardia (rate 160) of short duration, which recurred on the 19th and 20th, the longest attack lasting about twenty minutes. In the intervals the rhythm remained regular until 24th March, twelve days after the quinidine was stopped, when the irregular rhythm set in again.

A fourth course of quinidine was accordingly begun on the 24th, 4 grams being given night and morning. This time the rhythm became almost regular within eight hours, and completely so within two days, and continued until the patient's discharge from hospital on 17th April. The quinidine was continued in the above doses until the 6th April, when it was stopped. At the time of discharge the patient presented no symptoms, and was able to be up for the greater part of the day without any discomfort.

Case III.—Auricular fibrillation of at least two years' duration. Signs of cardiac decompensation. Reacted moderately well to digitalis. After a preliminary (0.2 gram) dose of quinidine, a course of 39.2 grams extending over a period of twenty-six days was given. No beneficial effect whatever was observed; no toxic symptoms.

J. D., male, aged 66, millwright, has done no work for past two years, during which period he has been eight times in hospital suffering from emphysema, mitral incompetence, auricular fibrillation, and myocardial failure. He was well until four years ago, when he began to suffer from shortness of breath, palpitation, weakness, and dizziness. Two years ago while at work he had a sudden fainting attack with transient aphasia, for which he was admitted to hospital for the first time.

State on Admission.—Well-nourished man; walked into hospital. Considerable dyspnœa; no œdema or cyanosis. Physical signs of emphysema of the lungs and very slight bronchitis. Wassermann negative. Arteries thickened. Pulse 81, completely irregular in rhythm and force; deficit of 15. Apex-beat in the fifth space 12.5 cm. from mid-sternal line. Heart sounds of poor intensity; in mitral area first sound is followed by a soft systolic murmur propagated to the axilla. Second pulmonic sound slightly accentuated. Systolic blood pressure 135; diastolic 85. Polygraph tracing (24th February 1922) showed complete irregularity of the jugular and radial pulses, with absence of *a* waves.

Treatment and Progress.—Tinct. digitalis, 45 minims daily. On 28th February dyspnœa was much less, and pulse deficit had dropped to 6; patient felt much easier. On 2nd March trial dose of 0.2 gram quinidine was given; no reaction. On 3rd March digitalis was discontinued and 0.4 gram quinidine thrice daily was begun, and on 9th March it was increased to four doses daily. On the 28th March, after a total dose of 39 grams spread over twenty-six days, the quinidine was stopped, the pulse being still absolutely irregular in force and rhythm.

Commentary. — The three cases of auricular fibrillation reported above are probably influenzal, rheumatic, and secondary to emphysema of the lungs and arterial disease, respectively. Case I. was fibrillation of a few weeks' duration with good compensation. A normal rhythm was established after 2 grams of quinidine had been given, and was maintained thereafter. Case II. was of longer standing—at least one year's duration—and was complicated by disease of the mitral valve and associated with signs of failure of the myocardium. It offers a good illustration of the value of quinidine (1) in restoring normal rhythm,

and (2) in maintaining the normal rhythm when given in smaller doses. Three times, when quinidine was stopped, did fibrillation return, to be again abolished by the resumption of the drug. To maintain normal rhythm a dose of not less than 1·2 gram daily was at first required; latterly 0·8 gram was found sufficient. The question may be raised, Do the beneficial effects of a normal rhythm justify the prolonged use of so powerful a drug as quinidine? and it must be admitted that a satisfactory reply cannot yet be given. But the patient in question has now been under observation and treatment for twelve weeks, and her progress has been entirely satisfactory. She is free from all symptoms, feels quite well, and is up for the greater part of the day. It appears to us that, since the myocardial lesion to which fibrillation is due is in the great majority of cases a permanent one, quinidine is only likely to prove of real value in the management of cardiac cases if it should be found possible so to adjust the dose as to allow of its administration over considerable periods of time, as is the case with digitalis. The case we now report suggests that with some patients at least this may be possible. Case III. is calculated to prevent undue optimism, as there was no response whatever to quinidine in the doses given In explanation of this failure we may invoke a second action of quinidine not hitherto referred to. In addition to lengthening the refractory period, it is said to slow the conduction in the auricular muscle, and it is easy to see that if this effect should preponderate over the former, fibrillation may be favoured rather than checked. The study of further cases may in the future establish with more certainty the nature of its action, the dosage, and the risks of toxic and secondary effects particularly when it is given over long periods.

We have to express our indebtedness to Dr Murray Lyon for his kindness in taking the electro-cardiograms in these cases.

REFERENCES.—[1] Ellis and Clarke Kennedy, *Lancet*, 1921, ii., p. 894. [2] Lewis and others, *ibid.*, p. 514. [3] Lewis, *Brit. Med. Journ.*, 1921, ii., pp. 551, 590. [4] White, Marvin, and Burwell, *Bost. Med. and Surg. Journ.*, 1921, clxxxv., p. 647.

OBSERVATIONS ON SPINAL ANÆSTHESIA.

By D. N. KALYANVALA, M.R.C.S. Eng., Late Assistant Medical Superintendent, Chelsea Infirmary, London.

(*Concluded from page* 33.)

Post-Operative Headaches.—One can divide these into two classes:—

(1) *Frontal Type.*—This is fairly common and is probably due to the pharmacological action of stovaine. As a rule it is mild and passes off in a short time.

(2) *Occipital Type* (Meningeal).—Fortunately this condition is met with rarely (twice in this series of 81 cases—Nos. 5 and 35). One may come across a similar condition even after simple lumbar puncture. Occasionally a patient may complain of slight degree of stiffness of the neck, but it is never troublesome and the symptoms pass off in a few days. A typically acute case presents the following picture. Headache is of the severe occipital type, with tenderness and rigidity of the nape of the neck, or accompanied by backache. There is also dizziness followed by nausea and vomiting; these features are distinctly aggravated by movements of the head, such as raising of the head. The patient prefers to lie flat and keep the eyes closed. In some cases there is marked restlessness and insomnia. This is the only post-operative complication which I have met with in my practice of spinal anæsthesia where patients undoubtedly looked miserable, and I may add that it was the only condition where a patient really preferred general anæsthesia. Prior to the use of omnopon and scopolamine, neurotic patients disliked the idea of remaining conscious during the operation, but since then those who have had previous experience of general anæsthesia gave preference to spinal anæsthesia.

The treatment of headache is to keep the patient in a dark and quiet room and the head should be kept low, in fact some cases are relieved by raising the foot of the bed. Cold compresses to the head and nape of the neck may also help to relieve the condition. As regards the drugs morphia, or better still omnopon, and in some of the frontal types trional, aspirin, or bromides are useful. In two cases, one following a stovaine glucose anæsthesia and another following a simple

lumbar puncture, the severe occipital headache was relieved by an attack of epistaxis; probably a timely lumbar puncture would have prevented epistaxis in these cases. Therefore if the acute condition does not improve soon, a lumbar puncture should be resorted to and 5 or 10 c.c. of the fluid be withdrawn. It is interesting to note that in two cases of headache, one after spinal anæsthesia (Case 35), and another after a lumbar puncture for diagnostic purposes, withdrawal of the fluid gave immediate relief though the intra-spinal pressure was low (below $2\frac{1}{2}$ in.).

In order to ascertain the relations of the *blood pressures* to headache, in the last series of 66 cases, I have been carefully keeping the records of blood pressures taken before, during, and after all lumbar punctures. Further, with a view to determining how far the changes in cerebro-spinal fluid were responsible for different complications, I have used the manometer as a routine in all lumbar punctures performed in the wards or for spinal anæsthesia. For experimental purposes various quantities were withdrawn in different cases, then again different quantities were withdrawn in the same patient if lumbar punctures were repeated.

From the comparisons of these various cases of lumbar punctures, I think the following inferences may be drawn:—

(*a*) That no simple relationship exists between the arterial blood pressure and intra-spinal pressure. Very often high blood pressure was noticed with low cerebro-spinal pressure and *vice versa*.

(*b*) That changes in arterial blood pressure has no influence over the intra-spinal pressure, and the drugs that lower or raise the blood pressure, *e.g.* nitrites or adrenaline, have very little effect on intra-spinal pressure, as observed in some cases by a subsequent puncture, and have no beneficial effect in relieving the headache.

(*c*) That arterial blood pressure, whether high or low previous to lumbar puncture, has no relationship to post-operative headache. In two cases where headache was severe and relieved by epistaxis, the blood pressures were 120 and 80 mm. respectively.

(*d*) That no definite relationship is discovered between this headache and the preliminary intra-spinal pressure.

(*e*) That headache is not dependent on the quantity of fluid withdrawn.

(*f*) That from the three cases where lumbar punctures

were performed for occipital headache, I doubt if the headache is due to increased intra-spinal pressure. In those cases the intra-spinal pressure was recorded low (under 2½ in.). Two out of these three had epistaxis.

(*g*) That slight occipital headache, dizziness, and nausea were noticed at times even after simple lumbar punctures, especially where a certain amount of difficulty was encountered in performing them. This evidently shows that headache, after spinal anæsthesia, must be due to trauma, probably producing irritation of the meninges, and not due to stovaine. In many cases I believe lack of experience or of gentleness are responsible factors. Preliminary anæsthesia of the skin and the tract of lumbar puncture are therefore very useful, as I have already explained.

(*h*) That headache was distinctly more common in nervous people or where the patients had been restless on the table or had been jolted about in removal to the ward. Administration of twilight sleep, prevention of all disturbances in the ward or in the theatre, and careful handling of the patient, have proved of great value in diminishing cases of headache.

(*i*) That patients who were kept flat for twenty-four hours after the operation were less prone to suffer than those who were put in Fowler's position. The latter position should therefore be avoided unless absolutely necessary.

Nervous Lesions following Spinal Anæsthesia.—In my practice I have never come across any case of paresis even of temporary nature. I have noticed a case of sciatica lasting for three days; the injection was given in third lumbar space.

I should like to record a very unusual condition reported to me once by the Sister of the ward, four hours after the operation (Case No. 31). The patient, who was still under the effects of omnopon and scopolamine, was noticed with his face drawn up on the right side and the right pupil distinctly larger than the left one. There was no squint and the condition passed off in about an hour.

I have also noticed a case of retention and incontinence of urine (Case No. 69). Here a Bassini's operation was performed for a strangulated scrotal hernia; the condition of the patient was very poor, owing to advanced pulmonary tuberculosis. The condition lasted for about a week.

Albuminuria.—Examinations of urine occasionally revealed slight traces of albumen, but it disappeared in a few days.

I desire to thank my colleagues at Chelsea Infirmary for their kind assistance, and the Nursing Staff for the careful preparation and after-treatment of the patients. I am also indebted to Dr Barr of the National Physical Laboratory for his suggestions and estimation of the "depression of the freezing-points" of the stovaine solutions; and to Messrs Allen and Hanbury for the exact and careful workmanship of the spinal manometer devised by me.

REFERENCES.—[1] Berkley and Hartley, "Osmotic Pressures," *Phil. Trans.*, 1906, vol. ccvi., p. 486. [2] Ewan, "Freezing-points of Glucose Solutions," *Physiol. Chr.*, 1894.

[TABLES.

No.	Age.	Sex.	Preliminary Injections.	Nature of Operations.	Solution used and Dosage.	Blood Pressure before Injection of Stovaine.
						mm.
1	78	M.	Morphia atropin	Amputation, thigh . .	Stovaine glucose 2 c.c.	...
2	64	M.	,,	,, . .	,,	...
3	64	F.	Nil	Strangulated femoral. Resection of bowel	,,	...
4	68	M.	Morphia atropin	Suprapubic prostatectomy .	,,	...
5	36	F.	Nil	Radical cure, strangulated femoral	,,	...
6	56	M.	Morphia atropin	Internal piles . . .	,,	...
7	65	M.	,,	Amputation, thigh . .	,,	...
8	65	M.	,,	,, . .	,,	...
9	68	M.	,,	,, . .	,,	...
10	43	M.	,,	Interno-external piles .	,,	...
11	60	M.	,,	Suprapubic cystostomy .	,,	...
12	56	M.	,,	Amputation, thigh . .	,,	...
13	72	F.	Nil	Bassini's, for strangulated inguinal hernia	,,	...
14	55	F.	Morphia hyoscin	,, ,,	,,	...
15	44	M.	,,	Ilio-sigmoidostomy . .	Stovaine saline 1 c.c.	...
16	44	M.	,,	Laparotomy . . .	,,	120
17	40	F.	,,	Amputation, thigh . .	Stovaine glucose 2 c.c.	110

Observations on Spinal Anæsthesia

Blood Pressure after Injection of Stovaine.	Intra-spinal Pressure in Inches.	Level of Anæsthesia.	Complications during Operation.	Post-operative Complications.	Remarks.
mm.					
...	...	Umbilicus	Nil	Nil	...
...	...	Groin	,,	,,	Injected in sitting posture; took twenty minutes to anæsthetise the level of the groin.
...	...	Iliac crests	Retching, vomiting, noisy	Headache, vomiting	Traction on bowel felt.
...	...	Midway between umbilicus and xiphoid process	Nil	Nil	...
...	...	Incomplete groins	Noisy, vomiting, and shivering	Severe occipital headache, epistaxis	Slow diffusion.
...	...	Groins	Nil	Nil	...
...	...	Umbilicus	,,	,,	...
...	...	,,	,,	,,	...
...	...	,,	,,	,,	...
...	...	Groins	Shivering	,,	...
...	...	Between umbilicus and xiphoid process	,,	,,	...
...	...	...	Nil	,,	No effect though puncture easy and successful. Syringe boiled in soda solution probable cause of failure. Operation performed under A.C.E.
...	...	Umbilicus	,,	,,	...
...	...	Xiphoid process	,,	Slight occipital headache	...
...	...	,,	,,	Nil	...
...	3	,,	,,	,,	...
...	5	Failure to reach above knee	Shivering	,,	A.C.E. and ether given.

No.	Age.	Sex.	Preliminary Injections.	Nature of Operations.	Solution used and Dosage.	Blood Pressure before Injection of Stovaine.
						mm.
18	55	F.	Morphia hyoscin	Cholecystectomy . .	Stovaine saline 1 c.c.	110
19	38	M.	Morphia hyoscin	Internal piles . . .	Stovaine glucose 2 c.c.	120
20	48	F.	,,	Choledochotomy . .	Stovaine saline 1 c.c.	110
21	55	F.	,,	Wertheim's hysterectomy .	,,	110
22	60	M.	,,	Laparotomy and inguinal colostomy	,,	110
23	35	F.	,,	Vesico-vaginal fistula .	,,	120
24	47	M.	,,	Bassini's operation for strangulated scrotal hernia	,,	140
25	52	F.	Morphia atropin	Perforated gastric ulcer sutured and drainage peritoneal cavity	,,	100
26	66	F.	Omnopon scopolamine	Removal of thrombosed varicose veins	,,	130
27	39	M.	,,	Ischiorectal abscesses .	,,	120
28	42	F.	Morphia hyoscin	Removal of bands and adhesions for intestinal obstruction	,,	120
29	60	F.	,,	Radical cure, strangulated femoral hernia	,,	140
30	55	M.	,,	Amputation, thigh . .	,,	110
31	53	M.	,,	Gastrostomy . . .	,,	110
32	71	F.	Omnopon scopolamine	Wertheim's hysterectomy .	,,	110

Observations on Spinal Anæsthesia

Blood Pressure after Injection of Stovaine.	Intra-spinal Pressure in Inches.	Level of Anæsthesia.	Complications during Operation.	Post-operative Complications.	Remarks.
mm.					
...	5	Nipple line	Nil	Frontal headache, vomiting	A.C.E. combined during manipulations of the viscera.
...	6	Umbilicus	Nil	Nil	...
...	6	Nipple line	Shivering, noisy	Headache, vomiting	Morphia and hyoscin failed. A.C.E. during manipulation. Operated later on (see No. 35).
80	5	,,	Hyoscin delirium	Nil	Whiffs of A.C.E. given to keep patient quiet.
80	5	,,	Nil	,,	...
90	6	Xiphoid process	,,	,,	...
100	6	,,	,,	,,	...
...	6	Nipple line	,,	,,	In very toxic state owing to peritonitis. Note absence of vomiting on table in spite of low blood pressure.
120	6	Umbilicus	,,	,,	...
110	5	,,	,,	,,	...
100	7	Xiphoid	Noisy retching	Acute frontal headache, vomiting	Morphia and hyoscin failed. Whiffs of A.C.E. given to quiet the patient.
80	4	,,	Nil	Slight headache, vomiting	Note absence of vomiting on table. Under deep morphia and hyoscin.
100	5	Umbilicus	,,	Nil	...
80	4	Nipple line	,,	Facial spasm and inequality of pupils lasting for an hour	In very exhausted state. Note absence of vomiting on table, in spite of fall of blood pressure.
...	5	,,	Retching	Nil	A.C.E. in the end.

No.	Age.	Sex.	Preliminary Injections.	Nature of Operations.	Solution used and Dosage.	Blood Pressure before Injection of Stovaine.
						mm.
33	46	M.	Omnopon scopolamine	Gastric ulcer . . .	Stovaine saline 1 c.c.	110
34	72	F.	Nil	Laparotomy . . .	Stovaine saline 0·5 c.c.	110
35	47	F.	Omnopon scopolamine	Laparotomy and removal of adhesions	Stovaine saline 1 c.c.	110
36	70	M.	Morphia atropin	Amputation, thigh . .	Stovaine glucose 2 c.c.	130
37	41	F.	Omnopon scopolamine	Cholecystostomy . .	Stovaine saline 1 c.c.	120
38	24	F.	Nil	Suppurative arthritis, knee joint	Stovaine glucose 2 c.c. (failed)	...
39	35	F.	Omnopon scopolamine	Drainage of sub-hepatic abscess	Stovaine saline 0·6 c.c.	120
40	37	M.	,,	Cellulitis, leg . . .	Stovaine glucose 1 c.c.	130
41	80	M.	,,	Colostomy. . . .	,,	140
42	64	M.	Nil	Laparotomy and colostomy	,,	120
43	62	F.	Omnopon scopolamine	Ventro-suspension of uterus	Stovaine saline 0·7 c.c.	120
44	25	M.	,,	Interno-external piles .	Stovaine glucose 1 c.c.	140
45	35	M.	,,	Varicose veins . . .	,,	120
46	26	F.	,,	Peritonitis, laparotomy, and drainage	Stovaine saline 1 c.c.	110
47	24	F.	,,	Salpingectomy and appendicectomy	,,	120
48	24	F.	,,	Salpingectomy . . .	,,	110

Observations on Spinal Anæsthesia

Blood Pressure after Injection of Stovaine.	Intra-spinal Pressure in Inches.	Level of Anæsthesia.	Complications during Operation.	Post-operative Complications.	Remarks.
mm. 80	6	Above clavicles	Stoppage of respiration for ten minutes	Nil	Operation postponed; performed under A.C.E. on another occasion.
...	4	Xiphoid	Nil	,,	...
...	6	Nipple line	Noisy, shivers	Severe occipital headache, relieved by lumbar puncture (2 in.)	Previously operated on under spinal (see No. 20). T.S. this time also failed. A.C.E. given to keep her quiet.
...	4	Umbilicus	Nil	Nil	...
...	10	,,	,,	Frontal headache, vomiting	Injection given in sitting posture failed to reach the desired level. A.C.E. given.
...	...	...	...	...	No effect, although puncture quite easy and successful. A.C.E. given. Ref. to No. 52.
90	6	Nipple line	Slight retching on manipulations of stomach	Slight frontal headache, vomiting	...
120	8	Umbilicus	Nil	Nil	...
...	3	Nipple line	,,	,,	...
...	5	Xiphoid	,,	,,	...
95	8	,,	,,	Coffee ground vomits and frontal headache	...
130	1½	Umbilicus	,,	Nil	Injection in sitting posture.
105	1½	,,	,,	Vomiting and frontal headache	...
80	5	Nipple line	Retching	,,	...
90	6	Xiphoid	Nil	,,	...
50	6	Nipple line	,,	,,	Note absence of vomiting on table. Under deep omnopon scopolamine.

No.	Age.	Sex.	Preliminary Injections.	Nature of Operations.	Solution used and Dosage.	Blood Pressure before Injection of Stovaine.
						mm.
49	67	F.	Omnopon scopolamine	Ventro-suspension of uterus	Stovaine saline 1 c.c.	160
50	75	M.	Nil	Laparotomy and relief of strangulated obturator hernia	Stovaine saline 0·5 c.c.	100
51	69	F.	Omnopon scopolamine	Bassini's operation for obstructed inguinal hernia	Stovaine saline 0·7 c.c.	100
52	24	F.	Nil	For suppurative arthritis, knee joint	Stovaine saline 0·7 c.c. (failed)	...
53	53	M.	,,	Fistulæ in Ano . . .	Stovaine saline 0·5 c.c.	120
54	45	F.	Omnopon scopolamine	,, . .	,,	120
55	62	F.	,,	Colporrhaphy . . .	Stovaine saline 0·7 c.c.	105
56	59	M.	,,	Radical Bassini scrotal hernia	,,	125
57	64	F.	,,	Uterine fibroids . .	Stovaine saline 1 c.c.	120
58	23	F.	,,	Cholecystostomy . .	Stovaine saline 0·7 c.c.	120
59	22	F.	Nil	Scraping tubercular sinuses, hip	Stovaine saline 0·5 c.c.	100
60	43	M.	Omnopon scopolamine	Varicose veins . . .	Stovaine saline 0·6 c.c.	120
61	48	M.	,,	,, . . .	,,	130
62	43	M.	,,	,, . . .	,,	130
63	54	M.	,,	,, . . .	Stovaine glucose 1 c.c.	120
64	70	M.	Nil	Laparotomy and drainage for diffuse peritonitis	Stovaine saline 0·3 c.c.	150

Blood Pressure after Injection of Stovaine.	Intra-spinal Pressure in Inches.	Level of Anæsthesia.	Complications during Operation.	Post-operative Complications.	Remarks.
mm. 130	5	Xiphoid	Nil	Frontal head-ache	...
65	4	,,	,,	Nil	In very toxic state.
75	5	,,	,,	,,	...
...	...	...	...	...	This patient on a previous occasion failed to respond to stovaine glucose. Evidently a case of immunity (see No. 38).
110	6	Umbilicus	Nil	Bilateral sciatica for three days	...
115	5	,,	,,	Frontal head-ache	...
95	4	Xiphoid	,,	Nil	...
105	4	,,	,,	,,	...
80	2½	Above clavicles	Stoppage of respiration for twenty minutes	Frontal head-ache, vomit	Operation postponed.
80	5	Nipple line	Vomiting	Frontal head-ache, and vomiting	...
75	6	Above nipple line	,,	,,	...
110	4	Umbilicus	Nil	Nil	...
115	1	Xiphoid	,,	,,	...
100	6	Umbilicus	,,	,,	Operated on previously under spinal (see No. 60).
80	4	Nipple line	Retching and vomiting	,,	...
110	1	,,	Nil	,,	Note the low intra-spinal pressure and high diffusion in spite of small dose. In very toxic state.

No.	Age.	Sex.	Preliminary Injections.	Nature of Operations.	Solution used and Dosage.	Blood Pressure before Injection of Stovaine.
						mm.
65	71	M.	Omnopon atropin	Bassini's operation for scrotal hernia	Stovaine saline 0·5 c.c.	140
66	32	M.	Omnopon scopolamine	Interno-external piles .	Stovaine glucose 1 c.c.	140
67	45	M.	,,	Varicose veins . . .	Stovaine saline 0·5 c.c.	140
68	48	M.	,,	,, . . .	,,	110
69	65	M.	Nil	Radical operation, strangulation scrotal hernia	Stovaine saline 0·6 c.c.	115
70	41	F.	,,	Radical operation, strangulated femoral hernia	,,	120
71	61	M.	,,	Suprapubic prostatectomy .	,,	105
72	58	F.	,,	Enterostomy . . .	,,	130
73	68	M.	Omnopon scopolamine	Interno-external piles .	Stovaine saline 0·5 c.c.	135
74	68	M.	,,	Wiring fractured patella .	,,	120
75	58	M.	,,	Piles	,,	105
76	70	M.	,,	Ischiorectal abscess and perinæal fistulæ	,,	130
77	45	M.	,,	Radical Bassini, strangulated scrotal hernia	Stovaine saline 0·7 c.c.	120
78	69	M.	,,	Wiring fractured patella .	Stovaine saline 0·5 c.c.	150
79	65	F.	,,	Sequestrectomy. . .	,,	140
80	60	M.	,,	Varicose veins for ulcer .	,,	170
81	65	M.	,,	Sequestrectomy . .	Stovaine saline 0·7 c.c.	140

Observations on Spinal Anæsthesia

Blood Pressure after Injection of Stovaine.	Intra-spinal Pressure in Inches.	Level of Anæsthesia.	Complications during Operation.	Post-operative Complications.	Remarks.
mm. 110	2	Xiphoid	Nil	Nil	...
120	8	Umbilicus	Noisy and shivering	Frontal headache and slight occipital	...
125	10	,,	Nil	Nil	...
105	7	,,	,,	,,	Operated on previously under spinal (see No. 60).
100	2	Xiphoid	,,	Incontinence of urine for a week	In a very feeble state owing to pulmonary tuberculosis.
105	4	,,	Retching	Nil	...
70	2	,,	,,	,,	...
80	2	Groins	Nil	,,	Failed to inject in lateral position, sitting posture adopted. Was in a very toxic state. A.C.E. given.
120	9	Umbilicus	,,	,,	...
80	Dry	Nipple line	Retching and vomiting	,,	...
100	2½	Xiphoid	Nil	,,	...
110	2½	Nipple line	,,	,,	...
110	10	Groins	,,	,,	Note high intraspinal pressure. Diffusion very slow and only up to groin. Pain during traction on the sac.
95	...	Nipple line	,,	,,	...
80	2	Xiphoid	,,	,,	Deep omnopon scopolamine sleep.
165	Dry	Umbilicus	Thirst	,,	Patient's head and shoulders were kept more elevated.
130	7	,,	Nil	,,	...

LETTER FROM VIENNA.

(*From our own Correspondent.*)

SINCE my last letter the medical men attached to the largest benefit society in Vienna have gone on strike for an increase in their fees. The demand they made was a very reasonable one and quite within the means of the wealthy Society which employed them. The social democratic leaders of the Society, however, did not follow the example of the next largest medical benefit association, which came to terms with its doctors, but adopted such an attitude towards them as to make negotiation impossible, with the result that a strike took place. The society leaders, preferring to expend their money on party ends rather than pay their doctors adequately, maintained an unyielding attitude for about two months, until the pressure of public opinion, and perhaps hints from the Government, began to make themselves felt, when they reopened negotiations which resulted in the doctors obtaining all their demands.

Up to the present time the Government has only kept one of the promises made to the Memorial of the Association of medical men to which I have already referred in a former letter. They have introduced a Bill for the regulation of medical practice. In the draft measure, which delimits the rights and duties of medical men, several new definitions have been introduced, which affect the conduct of practice throughout Austria, the use of the title doctor, the question of specialists, and the prohibition of medical practice. Another section regulates the statutory representative bodies of the medical profession. A medical Council is set up in every district of the country, the election of members being in the hands of all registered medical practitioners, except in so far as these may be disenfranchised by the Council itself for disciplinary reasons. Voting is secret, and by ballot. Members of Council hold office for from three to five years, and acceptance of office is compulsory by those elected.

The Councils have the power of dealing with all questions of professional competence and conduct, and can inflict punishments ranging from fines to permanent removal from the medical register. Another duty of the Council is to arbitrate in regard to disputes not involving money matters between doctors in its district; and in the event of the Council not being able to agree on an award in such cases provision is made for setting up an appeal tribunal consisting of jurists and medical men. The new law repeals all former legislation concerning medical practice, among this being a statute dating back to 1770.

This draft law has been the subject of an inquiry by an *ad hoc* Commission, on which all interests—medical, labour, legal, etc.—were

represented. The majority favoured the introduction into the medical course of a "practical year," after graduation, a measure which has not been introduced into this draft law, in view of forthcoming legislation regarding medical education in general. The form of election to the medical Councils evoked a good deal of difference of opinion, and it has been agreed to submit a motion on this subject to the medical men generally for their decision. The non-medical members of the Commission were strongly opposed to the extension of the disciplinary powers of the medical Councils so far as to allow of their removing offenders from the register and thus depriving them of the right to practise, but all the medical members refused to yield on this point.

On the whole, though the draft law leaves a good deal to be desired, it is welcomed as a step in the right direction, and there would be general satisfaction if the other undertakings of the government to the doctors seemed likely to be adhered to and carried out in the immediate future. Unfortunately, the change in the Government has greatly delayed further steps in the matter.

The year 1921 saw many losses through death among the profession in Vienna. Professor Zuckerkandl, one of the leading urologists, died during the year, and we also lament the loss of Dr Adolph Gruss, one of the protagonists of the medical profession in its struggle for improved status.

An attempt has lately been made to introduce some order into medical tariffs, by taking as a standard the pre-war fees, and multiplying them by some factor equivalent to the altered value of money. Enormously high figures are reached by this method, but they do not actually represent fees proportionate to those which were formerly charged. For this reason, many persons think that a new basis altogether should be sought, and it has been suggested to take as a standard the price of some necessary of life, such as fat, and make this a basis from which to compute fees. It is thought that by doing this, less odium will be incurred than by simply multiplying the previous fees by a large figure. If fat, or meat, or coal were taken as a standard in this way, the fees would rise by about a thousandfold, whereas at present they are only up by three hundredfold. At present nearly all those who before the war were private patients have been driven to become insured, and consequently have to be treated at relatively low rates.

NEW BOOKS

Treatment of Injuries of the Peripheral Spinal Nerves. By Sir HAROLD J. STILES and M. F. FORRESTER-BROWN. Pp. viii + 180, with 58 illustrations. London: Henry Frowde and Hodder & Stoughton. 1922. (Price 15s. net.)

We are grateful to Sir Harold Stiles and his former colleague at the Edinburgh War Hospital, Bangour—Dr Forrester-Brown—for this authoritative monograph on nerve surgery, which within moderate compass summarises for the benefit of the general surgeon the conclusions they have arrived at after an exceptionally wide experience of nerve injuries.

In no field of surgery, probably, have our pre-war conceptions been more thoroughly upset than in that relating to traumatic lesions of the peripheral nerves, and the intensive study of large numbers of cases of such lesions in military hospitals has resulted in a simplification of the methods of diagnosis, the principles governing prognosis, and the operative and post-operative measures required to restore function. In the work now before us we have indicated the high-water mark of achievement in this field by two workers who have materially contributed to our knowledge of the subject.

While we can trace the hand of both authors throughout, there is internal evidence that the first section, dealing with the more general questions involved, is chiefly the work of Dr Forrester-Brown, while for the second part, which includes the description of operations, her co-worker, Sir Harold Stiles, is mainly responsible. This does not connote any inequality in the standard of attainment: it merely indicates that the particular experience of each author has been embodied in the work. The illustrations are excellent.

History of the Great War, based on Official Documents. Medical Services. General History. Vol. I. By Major-General Sir W. G. MACPHERSON, K.C.M.G. Pp. xvi + 463. London: H.M. Stationery Office. 1921. (Price 21s. net.)

Seeing how large a part medical science played in the great European War, it is only natural that the medical history should be written at length. This first instalment indicates that those who are responsible for its production contemplate a work on an extensive scale. Twelve volumes are promised us, and it is hinted that the history has had to be limited for financial reasons. The present volume, which deals with medical services in the United Kingdom, can be read by every medical man, whether he served or not, with the

full assurance that somewhere or another it will revive some half-forgotten memories—of the early days of recruiting, of V.A.D. hospitals, or the general muddle of 1914. Looking back on it all, it seems more than ever wonderful, not that so many mistakes were made, but that the thing was ever got through at all. General Macpherson deserves to be congratulated on his accurate and detailed description of a tale of work well done.

Epidemiology and Public Health. By VICTOR C. VAUGHAN, M.D., LL.D., assisted by HENRY F. VAUGHAN, M.S., D.Ph., and GEO. T. PALMER, M.S., D.Ph. 3 volumes. London: Henry Kimpton. (Price 45s. per volume.)

This is a big work, the first volume of which is now before us. The first part concerns itself with respiratory infections. The principal author is a man of wide experience and a capable exponent of his specialty. Like the majority of American writers, Dr Vaughan discourses in a most attractive way on the different themes treated by him. The book is in truth a mine of helpful information. The treatment of the various diseases is very complete, and the author's personality runs through the pages. Cerebro-spinal meningitis, influenza, and tuberculosis are specially well discussed as to origin, epidemiology, bacteriology, and methods of control. We have not thoroughly tried the Schick and allied tests in this country. Dr Park of New York is freely quoted, so that the reader gains a very clear conception of the practice of diphtheria control as indulged in in America. Dr Park is one of those who believes that a universal application of the Schick test with toxin-antitoxin exhibition would go far towards reducing the spread and incidence of diphtheria to vanishing point. Dr Vaughan's views on infection, which he discusses under the chapter on Albuminal Diseases, are well worth reading. We shall look forward to the succeeding volumes, as the first everywhere shows evidences of originality and painstaking work. It will prove a valuable work of reference to all who are directly or indirectly interested in preventive medicine. The book is clearly printed and many helpful charts are interpolated.

How to be Happy and Useful from Sixty to Ninety. By A. LAPTHORN SMITH, B.A., M.D., M.R.C.S., with Foreword by Sir Charters Symonds, K.B.E., F.R.C.S. Pp. xv. + 237. London: John Lane. The Bodley Head, Ltd. 1922. (Price 5s. net.)

Dr Lapthorn Smith in this interesting book founds his precepts on practice. He furnishes a number of striking examples of men and women who have been both useful and happy between the ages

mentioned in the title, and shows that they were happy because useful, and healthy in mind and body because happy, temperate, and active.

Although no doubt many of the examples chosen were persons of unusual ability, the injunctions deduced from their lives will hold good for everyone, because this simple, general principle underlies them all—health of mind and body can only be maintained by functional activity: stagnation fosters decay. The author rightly lays stress on the brain, and warns those who at a given age, say sixty, retire from an active, busy life to one of easy repose, that the change is apt to shorten life, not to lengthen it, as they might easily suppose. The loss of functional activity of brain cells will lower their standard of efficiency, and before long the man's previously keen mental powers will slip into senile decay. If, at the same time, the bodily powers are allowed also to lie fallow, they too, in decaying, will keep pace with the failing brain.

This, as Dr Smith explains, is why so many men go rapidly downhill after retiring from business.

The author writes in a genial, kindly way, as if talking to a friend, and encourages him to believe that he too may be happy and useful, even if he should have reached, or be near, that dangerous period of "too old at sixty."

We heartily commend this fascinating book to our readers of all ages.

Symptomatology, Psychognosis, and Diagnosis of Psychopathic Diseases. By Boris Sidis, A.M., Ph.D., M.D. Pp. xix. + 448. Edinburgh: E. & S. Livingstone. 1921. (Price 21s. net.)

This book is mainly valuable from what it says about hypnotic and allied states, a subject to which the author has given many years of attention. His philosophy is apparently in the main sensationalist; thus he considered dreams and other hallucinations to be caused primarily by sense-impressions, and the vividness of dreams to depend on the number of secondary sensory elements which automatically "join in." *Pace* Freud, he holds that there are no "memories" involved in dreaming. Sense-impressions cause dreams under conditions of dissociation (which latter conditions are not, however, themselves adequately "explained": our author deals, in fact, rather with the manifest than with the latent dream-content). His sensationalistic bias makes him, in considering perception, fail to do justice to the *social nature* of the percipient, his experience of mob-psychology would almost seem to have put him out of humour with "society" in general. The fierceness of his repeated invectives against Freudism is obviously greater than the circumstances necessitate, and must be referred to some personal experience or complex. "Not a single psychologist or psycho-

pathologist of note," he says, "accepted Freud's sexual phantasies and oneiromancy." We wonder what he makes of his fellow-countryman J. J. Putnam, to mention but one name! Nevertheless, in these days of dominant "systems" it is well that we should hear all sides, and in this book we have psychoanalysis dispossessed and "psychognosis" entering into its heritage. This latter method is more sensible that it sounds; it really means "treatment by all methods at our disposal, by hypnoidal and hypnotic states, by examination in the waking state, by constant watching and observation, by drawing out the patient in discussion, or by closely observing him in his actions and behaviour in regard to his family, his friends and strangers, for a long period of time." Of the different methods included under psychognosis, Dr Sidis's specialty is production of "the hypnoidal state"; here the patient is half asleep or somnolent, and generally relaxed, and the author makes great claims for its efficiency, as well as for that of ordinary hypnosis, where this can be induced.

We find in this book the common fallacy of specialist psychology—that the mind is a kind of "energy," subject therefore to the ordinary physical laws of conservation and so forth. Yet, in practice, it is impossible to treat the mind as something absolute, something apart from the environment; they must be handled together, in their mutual relations.

NEW EDITIONS

Manual of Fevers. By Claude Buchanan Ker, M.D., F.R.C.P.E. Second Edition. Pp. xiii. + 334, with 21 illustrations. London: Henry Frowde and Hodder & Stoughton. 1922. (Price 12s. 6d. net.)

This volume, the *Little Ker*, is intended primarily for the use of students attending their course of "Fevers" at an hospital; but, assuredly, the student who buys it for this purpose will keep it as one of his most trusted friends in general practice. Each chapter is a picture of the particular disease described and leaves nothing to be desired in the matter of method and lucidity of description, or of sense and reasonableness in the advice as to treatment and management. The "Table of Infectious Diseases" at the end of the book, showing at a glance the periods of incubation, eruption, isolation, quarantine, etc., will be referred to very often, because it summarises essential information in a most accessible manner. To students and nurses and to all who practise medicine, this manual will be a very useful fountain of information and guide for reference.

New Editions

Index of Treatment. By Various Writers. Eighth Edition. Edited by Robert Hutchison, M.D., F.R.C.P., and James Sherren, C.B.E., F.R.C.S. Pp. xviii. + 1021. Bristol: John Wright & Sons, Ltd. 1921. (Price 42s. net.)

This excellent and comprehensive work was first published fifteen years ago. In the present edition some of the articles have been rewritten entirely, whilst new articles have been inserted dealing with encephalitis, kala-azar, snake-bite, transfusion, the surgical treatment of constipation and other subjects. The articles are written by specialists, and for the most part they are excellent digests of modern views. It is disappointing, however, to find that nothing has been added to what appeared in the original edition in 1907 on such subjects as influenza and broncho-pneumonia, and some of the articles on infectious diseases are as they appeared in the first edition. But the unhelpful articles are few and the really admirable ones are many. The introduction is an admirable article and it might well be read once a year by every practising doctor.

Mentally Deficient Children. By G. E. Shuttleworth, B.A., M.D., etc., and W. A. Potts, M.A., M.D., etc. Fifth Edition. Pp. xviii. + 320, with 39 illustrations. London: H. K. Lewis & Co., Ltd. 1922. (Price 10s. 6d. net.)

The new edition of Shuttleworth and Potts retains its familiar appearance, and contains thirty-six more pages than the last. The authors urge the importance of employing some series of tests in all examinations of defectives, and state that in high-grade cases and criminals this is essential. Among the tests discussed we see no mention of the well-known Porteus maze tests, which are valuable as an indication of practical capacity.

Goddard's claim to have shown that mental deficiency is a Mendelian recessive character is discussed, and the cautious opinion is expressed that "authority is attached to his conclusions." The table given in the fourth edition showing the great variations in the results of investigations of the Wassermann reaction has been omitted, but the authors state that even if the largest percentage yet obtained were proved to be correct it would not shake their belief in the importance of a morbid heredity. Juvenile delinquency in relation to mental deficiency naturally receives attention, and Dr Potts makes the important observation that delinquency often originates at an early age and consequently it is unfortunate that young prisoners, charged for the first time, and therefore discharged, are not properly studied and treated in accordance with the results of the investigation. In connection with the much discussed question of

sterilisation, the authors observe that, on the whole, American experience seems to afford little support for the practice. One would have liked a fuller discussion of the psychology of epilepsy, also of the mental and moral deterioration resulting from encephalitis lethargica. The new edition will maintain the reputation of the book as the best of the smaller handbooks on its subject.

NOTES ON BOOKS

This monograph on *Lymphosarcoma*, *Lymphatic Leukæmia*, *Leucosarcoma*, *Hodgkin's Disease*, by Dr L. T. Webster (The Johns Hopkins Hospital Reports), is based on the case sheets and autopsy reports of cases admitted to the Johns Hopkins Hospital, and it includes a comprehensive collation of cases from the literature. The author emphasises the close relationship between leucosarcoma, lymphosarcoma, and lymphatic leukæmia, and considers it probable that they constitute different manifestations of the same disease. The lymphocytic infiltration of the organs, in the different conditions, differs in quantity but not in quality. He regards lymphosarcoma not as a neoplasm but as a direct response on the part of lymphocytes to a chemotatic influence exerted by the disease-causing agents—the presence of this substance in any tissue or organ producing there a local accumulation of lymphoid cells.

The seventh edition of Sir John Bland Sutton's *Tumours: Innocent and Malignant* (Cassell & Company, Ltd., 1922, price 30s. net) is certain of a warm welcome, including as it does all the fruits of recent investigation. Much of the work that has been done on the ductless glands and the relationship between them and various tumour growths is now incorporated in the text. The sections on carcinoma have been amplified, and the importance of warts, abrasions and chronic ulcers in the gastro-intestinal tract as precursors of cancer is given greater prominence. The other sections have also been brought up to date and twenty new illustrations have been added.

The unfailing excellence of the *Collected Papers of the Mayo Clinic* (W. B. Saunders Company) is already well known. It is therefore unnecessary to do more than announce the publication of Vol. XII., 1920, edited as usual by Mrs Mellish.

Operative Surgery by John J. M'Grath, M.D., F.A.C.S. (F. A. Davis Company, price $8·00 net) has been completely revised in this its sixth edition. The part of the work devoted to surgical anatomy is clear and well illustrated. Operative procedures, however clearly described, must be fully illustrated if they are to be intelligible to the student, and this has not always been done. No mention is made of

the methods employed by Kocher in the excision of joints, and in the description of Syme's amputation at the ankle the incision given does not conform with the original.

NOTES

Dr Edwin Bramwell has been appointed Moncrieff-Arnot Professor of Clinical Medicine in the University of Edinburgh, *vice* the late Professor F. D. Boyd.

The following appointments have recently been made to the Staff of the Royal Infirmary: Mr George L. Chiene to be Surgeon; Dr W. T. Ritchie to be Physician; and Mr J. N. J. Hartley to be Assistant-Surgeon.

The Victoria Jubilee Cullen Prize of the Royal College of Physicians of Edinburgh has been awarded to Dr John Thomson and Dr Norman Walker.

BOOKS RECEIVED

Ashby, H. T., and C. Roberts, Revised by. Ashby and Wright's Diseases of Children. Sixth Edition . (*Oxford Medical Publications*) 42s.

Caillé, Augustus. Post-Graduate Medicine: Prevention and Treatment of Disease . . . . . (*Appleton & Co.*) 40s.

Cummer, Clyde Lottridge. A Manual of Clinical Laboratory Methods (*Henry Kimpton*) 28s.

Eager, Richard. Hints to Probationer Nurses in Mental Hospitals (*H. K. Lewis & Co., Ltd.*) 1s. 6d.

Epps, William. Anderson Stuart, M.D. . . (*Angus & Robertson, Ltd.*)

Gittings, J. Claxton, Frank Crozer Knowles, and Astley P. C. Ashhurst. Tuberculosis in Infancy and Childhood (*J. B. Lippincott Co.*) 21s.

Kroenig and Friedrich. Translated by Henry Schmitz. The Principles of Physics and Biology of Radiation Therapy . (*Wm. Heinemann*) 42s.

Levy, A. Goodman. Chloroform Anæsthesia (*John Bale, Sons, & Danielsson, Ltd.*) 7s. 6d.

Medicine. Analytical Reviews of General Medicine, etc. Vol. 1, No. 1, May 1922 . . . . . (*Williams & Wilkins Co.*)

Pottenger, Frances Marion. Symptoms of Visceral Disease. Second Edition . . . . . (*Henry Kimpton*) 28s.

Potter, Irving W. The Place of Version in Obstetrics (*Henry Kimpton*) 25s.

Poulton, E. P. Taylor's Practice of Medicine. Twelfth Edition. (*J. & A. Churchill*) 30s.

Scott, Thomas Bodley. Endocrine Therapeutics (*H. K. Lewis & Co., Ltd.*) 5s.

Simpson, Frank Edward. Radium Therapy . . (*Henry Kimpton*) 36s.

Edinburgh Medical Journal

September 1922

THE TREATMENT OF DISABILITIES OF THE HAND AND WRIST: AN ANATOMICAL REVIEW IN RELATION TO FUNCTION.

By WILLIAM A. COCHRANE, M.B., F.R.C.S.E., Boston, U.S.A, Clinical Assistant, Orthopœdic Dept., Massachusetts General Hospital.

In this communication an attempt is made to analyse some points in the anatomy of the hand and wrist which have to do with the function of the member, in relation to the power of grasping and the carrying out of its finer movements, and to illustrate their application in some of the commoner disabilities. While the disabilities and problems of treatment of the spine, and of the large joints such as the knee, hip, ankle, and foot receive careful study and reference in practice and in the literature, it is noteworthy that the main anatomical guides are too often ignored or insufficiently stressed when the hand and wrist are considered. While in the case of the hand and wrist many pitfalls are avoided by the early institution of massage and active motion, so that the member as a working machine is never stopped and taken down, as in the deliberative operative procedures of reconstructive surgery, or put out of action by severe forms of injury, it is just there that fundamental principles related to function require recognition. Thus a minor form of injury or infection can easily result in a major disability if certain fundamentals are neglected, and by the same token, if they are applied in a sound plan of splinting and physio-therapy, based on a knowledge of the mechanism of the hand, a functionally useful member can be promised in the very worst types of injury, sepsis, or paralysis. It is encouraging then to reflect that while, in cases of recent injury, our results should be capable of considerable improvement both as to ultimate function and time lost to the individual by methods of treatment

more or less standardised along the lines indicated, a good deal can be done by reconstructive and corrective physio-therapeutic measures — manipulation and splinting — where deformity, stiffness, and loss of function have developed or have been almost unavoidable. Surely nowhere in the body does the criterion of function as our standard for judging results develop greater significance than when the complexities of the hand and wrist are upset, and the conclusions of such bodies as the Fracture Committee of the British Medical Association in 1914, and of Commissions appointed from time to time by Industrial Insurance Companies to investigate the end results of injuries emphasise its especial importance, especially in regard to the restoration of loss of anatomic alignment.

While the writer has especially in mind the disabilities of the hand and wrist which accompany and follow injury—sprains, dislocations, and fractures—in this anatomical review, it should be emphasised that the principles involved have a universality of application in all other conditions of whatever origin, as they affect the hand and wrist. The various forms of arthritis, congenital deformity, poliomyelitis, injuries of the peripheral nerves as seen in the wrist-drop of radial nerve paralysis, and in the flattened, contracted, or clawed hand of median and ulnar nerve involvement would all have a place on such a list, mentioning also Volkmann's ischæmic paralysis and the evil effects of cellulitis and localised abscess.

What then, it may be asked, are the features to be guarded against most in this group of cases, and on what do they depend? The features which stand out as being the most disabling are joint stiffness in bad functional position, incompletely reduced deformity—in the case of fractures—and most important of all, the effacement of the mechanism on which the grasping power of the hand depends, in other words, the obliteration of the normal arches of the hand. Consideration of fractures in the region of the hand and wrist emphasise to us that in them, as in all articular and para-articular fractures, the effect of the injury upon the joint is of far greater importance than its effect upon the bone itself. Nowhere, save perhaps in the case of the foot and ankle, is it of greater moment to obtain union in good anatomic alignment; the proper working of the joint demands it in regard to its line of action and the adequate function of tendons acting on and over it. The lack of these

things is reponsible for the pain and weakness of grasp which many incompletely reduced cases of fracture present. A reactionary arthritis, accompanied by muscle-spasm and swelling, not infrequently develops, and non-union of a fracture of the carpal scaphoid leads to disability, dependent wholly upon the secondary arthritis set up in the wrist-joint.

The most advanced stage of the stiffened hand is not infrequently met with, a hand whose fingers bend little, if at all, whose arches are lost, whose thumb is in adduction and extension, and whose wrist is incapable of dorsiflexion.

A persistent swelling and œdema of the entire hand and wrist often accompanies such a picture in neglected cases of fracture of both bones of the forearm, and forms the main problem in the earlier stages of the treatment, in that if too long neglected it leads to permanent disability. At other times, as in the so-called "congealed" hand, the hand is atrophied and the skin glazed.

Whatever the factors at work in producing such a state of affairs in its minor and major gradations may be, most commonly prolonged immobilisation, ill-advised splinting and sepsis, when the swelling and œdema have been got rid of, the importance of maintaining the wrist in dorsiflexion and of preserving the arches of the hand, stand out especially in treatment.

The Arches of the Hand.—The hand may be said to present three arches, one longitudinal and two transverse, and the thumb stands in anatomical and functional relationship to each and all of them.

The position of slight flexion adopted by the fingers when at rest, along with the small but quite noticeable dorsal convexity of the carpus and metacarpus in the long axis of the limb, make it possible to refer to a longitudinal arch of the hand, and the disposition of the palmar fascia in forming the hollow of the hand helps to delineate it more clearly. When the integrity of the longitudinal arch is impaired, as occurs commonly after fracture of one or more of the four inner metacarpals, or in association with loss of the transverse arches, the anatomical sequela is limitation in the full flexibility of the metacarpo-phalangeal joints. There may even result a hyperextension deformity of the knuckles, with adaptive shortening of the structures on the dorsal aspect of the joints, a condition difficult to treat. A form of claw-hand may

subsequently develop, as in paralysis of the small muscles of the hand. Apparently what happens is that the lumbricales and interossei arising from the deep flexor tendons and metacarpals, and sweeping round the side of each proximal phalanx to gain attachment to the extensor expansions have, in fracture of the metacarpals, to operate at a disadvantage in flexing and fixing the metacarpo-phalangeal joints. In so far as they fail to do so, the unopposed extensor communis digitorum tendons hyperextend the knuckles and establish a clawed hand. In connection with the action of the interossei and lumbricales muscles, it is interesting to note that when they are paralysed, the long flexor tendons operate by simply curling up the fingers upon themselves.

If, in such a case of paralysis, the surgeon fixes the metacarpo-phalangeal joints in slight flexion, strong opposition and grasping movements are possible. In this complicated mechanism, therefore, the synergistic and fixative functions of flexor and extensor muscles are demonstrated, in that before the long flexor of the finger can flex the digits functionally, the extensor communis digitorum, interossei, and lumbricales must first fix the metacarpo-phalangeal joints in a position of slight flexion.

The stability and strength of the thumb is intimately bound up in the integrity of the radial half of the proximal transverse arch, and more especially upon the maintenance of the normal anatomical relationship at the carpo-metacarpal joint, where in radiograms of the normal hand the articular surface of the base of the metacarpal fits in close contact with the saddle-shaped articular facet on the trapezium. The metacarpal is buttressed in position there by the long tendons acting over it, in such a way that in the strong position of grasp, the long axis of the metacarpal, if produced proximally, passes through the long axis of the scaphoid, with which bone, after the trapezium, the mechanism of the thumb is most intimately connected. In many conditions of the hand that make for weakness, such as are found in elderly people who raise their weight from a chair by resting their weight on the hands, it is noticeable in X-ray photographs that the breadth of the carpus as a whole is increased, that the scaphoid has undergone a partial luxation from its deep, pocket-like articulation with the os magnum; the base of the first metacarpal is no longer in close contact with the trapezium, and the shaft of the bone has adopted a position

more clearly parallel to the other metacarpals and to the bones of the forearm.

A protective wristlet of leather which holds the bones in proper relationship often completely relieves this feature.

In the action of the thumb, also, the carpo-metacarpal joint is of much greater relative importance than the metacarpo-phalangeal joint, in that radiograms taken of the hand, first with a small object such as a pen held as in the act of writing, and then with the hand grasping a large object such as a glass of water, show that nearly all the motion takes place at the basal joint of the thumb; very little, if any, action takes place at the metacarpo-phalangeal joint (Fig. 1). It is therefore permissible to say that the basal joint of the thumb is the big factor in relation to function and the preservation of its widest range of motion, or in the event of ankylosis, its fixation in the optimum position for ankylosis, are points to which, in conjunction with the stability of the joint, we must devote a good deal of attention. There naturally follows, therefore, the next feature in relation to the thumb worthy of our attention, namely, that the full and proper function of the hand as a prehensile member demands that the first interosseous space be capable of being opened up to its fullest possible limits in the direction particularly of full abduction and opposition. The interference in all operations upon the basal joint of the thumb and in the splinting of the hand is obvious, in that abduction and opposition must be secured. A thumb in a position of adduction and extension is in a position absolutely fatal from a functional standpoint, be the cause what it may, and too often is this feature neglected, especially in paralysis of the thenar muscles.

Monks of Boston has pointed out that the shaft of the terminal phalanx of the thumb presents definite longitudinal axial rotation, in the direction suggested clinically by glancing along the dorsum of the terminal phalanx, when the asymmetry of the thumb-nail is noticed. In fractures of the phalanx, therefore, it is necessary to preserve such rotation.

The transverse arches are two in number, proximal and distal, and have what may be termed static and physiologic factors in their making. The proximal arch is composed of the carpal bones and carpo-metacarpal joints, and owes its formation to their particular shape and method of articulation. The arch is concave palmarwards and varies in depth in different hands, a normally high or low arch being found in the long, slender hand and in the short, broad hand respec-

tively. The arch is short, deep, and trough-like for the passage of the flexor tendons, and owes its preservation, in part, to the bowstring effect of the anterior annular ligament, a strong, fibrous band attached to its piers. In the oval-shaped trench of the proximal transverse arch, it is as though the reins of the flexor tendons were gathered up, before spreading out in a fan-like manner to their destination; in flexing the digits towards the hollow of the hand, the lateral support of the tendons provided by the side-walls of the carpal tunnel is essential for function.

No less important than the part played by the carpus in the skeletal formation of the arch is its maintenance by the muscles of the thenar and hypothenar eminences, and when they are paralysed or pressed upon and flattened out by such agencies as splints of the flat, board-like variety, the subjacent bony arch suffers in addition, and also the stability of the carpo-metacarpal joint of the thumb.

The physiologic, kinetic, or functional aspect of the proximal arch refers to the fact that the full use of the hand in grasping objects requires full abduction and opposition of the thumb. Flexion and extension of the thumb are regarded as taking place in the coronal plane, adduction and abduction in the sagittal plane of the body; the forearm is supinated and the limb hanging by the side in the anatomical position of parts, in computing these motions.

The distal transverse arch refers to one, more gently curving, formed by the heads of the metacarpals and their ligaments. It is broader than the proximal arch from which it springs, and is accentuated when the hand is in use by virtue of the slight flexibility palmarwards of the fourth and fifth metacarpals; such an arrangement aids the action of the flexor tendons in bringing the tip of each finger to a focal point in the palm: the opposition of the ring and little fingers is important functionally.

Some Deductions from the Foregoing.—The standard of function which has been set up as the criterion in adjudicating the final results of disabilities of the hand and wrist can be satisfied only when the preservation of these arches is given attention and their interdependence has been stressed. In the examination of crippled hands, it is striking how loss of the arches of the hand, joint stiffness, and tendon-stiffness form a trinity of difficulties. They depend very closely upon each other also from an operative standpoint, in that joint-stiffness

and deformity must be got rid of before any tendon operation is justified. It would be irrational to perform an operation for the repair of tendons when the joints are stiff. Again, in the flattened, adducted thumb of poliomyelitis or of median nerve paralysis, tendon operations must be carried out secondarily to the joint operation, sometimes advisable in these cases, of erasing the carpo-metacarpal joint of the thumb, aiming at a short, fibrous ankylosis in the position of grasp. If the order of the procedures is reversed, the tension on the tendons used in the transplantation is altered for the worse.

Closely bound up with the preceding is the position of election for the wrist. The power to grasp strongly can be present only when the wrist is in dorsiflexion. With the wrist fixed and held strongly in that position by the extensors, the power of the flexors is at their best. Radial or ulnar deviation may result from a variety of causes and are to be deprecated almost as much as flexion. In regard to the inferior radio-ulnar joint, the best position for it is that of complete supination, save in the event of ankylosis, when a position 15° short of complete pronation is probably best.

Thus it may be stated that in any disability of the hand and wrist—save a Colles' fracture in the first stage of treatment—major or minor, whether splints and adjuvant methods of treatment are employed or not, and whether the case is going to recover with motion or with ankylosis, if the member be placed in the anatomical and physiological position of grasp, the main desideratum has been attained, combined, of course, with full reduction of the deformity in the first instance. The wrist is dorsiflexed to an angle of 30° beyond the straight position and with no ulnar or radial deviation. The thumb is in a position of full abduction, and is rotated into a position of opposition in such a way that the plane of the four inner metacarpals meets the plane of the first and second metacarpal at nearly a right angle. The metacarpo-phalangeal joints are flexed 15° to 20° from the straight position and the interphalangeal joints 10° to 15°. The angle formed by the shafts of the first and second metacarpals is approximately 60° (Fig. 2).

Colles' Fracture.—There is more than one element in the displacement. The distal fragment carrying with it the hand, is displaced backwards and upwards *in toto*, to a varying degree. Both are rotated backwards (supinated) about the head of the ulna as a fixed point. Cotton[1] has laid especial emphasis on

the rotatory displacement, amounting really to a partial or complete anterior luxation of the head of the ulna, and points out that upon its recognition, along with the next essential displacement, a backward rocking of the distal fragment on the transverse diameter of the forearm, rests the rationalé of his advice concerning treatment. If the ulna is the fixed point about which the hand is displaced, it should be made the fixed point for effecting reduction; if the hand is displaced in extension, it should be replaced in flexion, and if it is displaced in a rotatory fashion by supination about the head of the ulna, it should be reduced in pronation. After reducing the major displacement, therefore, Cotton carries the hand about the head of the ulna into pronation and flexion. To do this, a good deal of force is directed up under the head of the ulna, strong traction flexes the hand and finally twists it into pronation about the head of the ulna.

Next to incomplete reduction, the greatest danger from a functional standpoint is loss of position, and a period of twelve to sixteen days' immobilisation in what is now called the Cotton-Loder position (Figs. 3 and 4) is the routine practice at the Massachusetts General Hospital; in the aged, the period is shortened to eight to ten days, as in them stiffness comes on more quickly. The position for fixation in the first instance, then, is with the hand flexed and rotated into extreme pronation and ulnar deviation. Anterior and posterior gutter splints made of plaster of Paris strips and moulded to the limb are applied, and retained by a few turns of a plaster bandage. The palmar piece must be well moulded to conform to the natural arches of the hand. The fingers and thumb are left free from the beginning. The method must be employed with care as circulatory disturbances are possible, and it is a rule to split the plaster and its lining at once. Such a position is of course the worst possible from a functional standpoint, and is justifiable only on the grounds that permanent stiffness is not to be feared; the wrist is then allowed to come up into the straight and then the dorsiflexed position.

Mention is made of severe sprain and dislocation of the wrist and of separation of epiphyses of radius and ulna, not to describe them in detail but simply to emphasise the main theme of this article, namely, that during the stage when splinting and fixation are required, whether by a long or by a short cock-up splint (Fig. 5), it should be the surgeon's first consideration to employ a splint that conforms to the arches of the normal

hand, as it takes up the physiological position of grasp. Splints such as are illustrated are eminently suitable and easily made from a plaster of Paris bandage. They are moulded to the limb in the desired position and are then suitably lined with white felt, the edges being protected by strips of adhesive plaster.

Fracture and Dislocation of the Bones of the Carpus.—The scaphoid and semilunar are those most frequently fractured, and when dislocation takes place it is generally of one of the bones of the proximal row. In forward dislocation of the semilunar, the proximal transverse arch is affected in so far that the anteriorly placed semilunar interferes with the action of the flexor tendons. The mechanism of the various types of fracture of the carpal scaphoid, their clinical manifestations and the radioscopic technique required to detect them, make an interesting study, but only one or two points can be taken up. The scaphoid usually breaks across its middle—the so-called "snapped-waist" type of fracture—the cause being a fall on the outstretched, abducted hand. At the moment of impact, the ulnar portion of the bone is firmly wedged in between the os magnum and the lower end of the radius and does not displace; the radial half of the bone is free and the scaphoid is therefore broken across at the junction of its fixed and movable portions, and in the event of displacement the radial half passes dorsally. If the displacement is not reduced, it limits dorsi-flexion of the wrist and at the same time destroys the bases of support for the thumb. The offending fragment must be removed, if it cannot be reduced.

Hitherto, the general concensus of opinion has been that fractured scaphoids do not often unite, the causes being given as interference with blood supply, bathing of the fragments in synovial fluid, and too free and early mobilisation. The writer can bear out the findings of Todd[2] that if the reduced fracture be immobilised for a period of three weeks on a long cock-up splint (Fig. 5), most cases will unite. At the expiration of that period a short cock-up splint may be substituted, and finally a protective wrist-strap. It is interesting to note that in Codman and Chase's[3] series only three out of thirty cases were immobilised for any length of time, and they were the only fractures to show union.

Treatment of Compound Fractures and Dislocations in the Region of the Wrist.—Infection may be prevented by a careful *débridement* operation; but when sepsis has developed in the wrist, the most important feature requiring attention,

in addition to the provision of drainage, is an appreciation of the fact that whether ankylosis is likely to supervene or not, the prophylaxis of treating the wrist in dorsiflexion must be observed. If the limb is splinted on a long cock-up splint in a position of supination, drainage is assisted by gravity, when a dorso-ulnar incision is employed. In these cases, also, the application of a banjo-finger traction splint (Fig. 6) is of great value in separating inflamed joint surfaces and providing the rest which of itself allays pain and sepsis. If the wrist has become stiff in a position of flexion, its attitude must be changed. This may be done best and with least reaction by a process of gradual correction, namely, by altering the angle of a long cock-up splint from day to day, bent at first to conform to the angle of deformity. Contrast baths, massage, and active and resistive exercises for the fingers and wrist are instituted. When the ankylosis is bony in character, the choice lies between a manipulation and an arthoplasty.

Fracture of the Metacarpal Bones. — In the oblique fractures from indirect violence, there usually is shortening and dorsal bowing of the fragments. The prominence of the knuckle is lost, and the head of the bone sinks into the palm and the longitudinal arch is injuriously affected.

Fractures of the metacarpals with displacement should be treated by finger-traction from the outset, maintained until callus has been thrown out. In this way the finger is brought down to length and the dorsal bowing corrected by a dorsal compression pad, with sometimes a palmar pad placed beneath the head of the metacarpal. A suitable apparatus is that used for the treatment of finger-joint stiffness (Fig. 6), but made from plaster of Paris, with incorporation of a rectangular piece of wire.

In the case of a Bennett's fracture, a suitable traction apparatus applied to the thumb alone is very efficient, the hand being in the position of grasp.

The Treatment of Stiffness and Deformity of Wrist, Thumb, and Fingers.—In regard to the wrist, there only remains to be added to what has already been said, that in the case of a labouring man, a wrist ankylosed in 30° dorsiflexion and with free supination and operation, nothing further should be attempted. When there is not this free rotation, from involvement of the inferior radio-ulnar joint, it may be restored by the removal of a small portion of the lower end of the ulna (Baldwin).[4]

In the case of the thumb, our aim is to attain full abduction and opposition. When there is present an adduction-extension deformity, much may be effected by physio-therapeutic measures and by proper splinting. The faulty position may be due to a variety of causes, such as the use of splints of the flat, board-like variety, paralysis of the thenar muscles, fibrous-tissue contracture from sepsis and injury in the first inter-osseous space; again, in cases of recurrent dislocation of the thumb at its carpo-metacarpal joint and in fracture in that vicinity, abduction and opposition may not be possible. Much may be done operatively to restore the thumb to the physiological position of grasp. The operation consists in an erasion of the carpo-metacarpal joint, with a view to obtaining a short fibrous ankylosis in full abduction and opposition. Traction applied in this position is desirable.

The treatment of *stiff fingers* remains to be described. The less severe cases may be relieved by prolonged immersions in hot and cold water. This "contrast" bathing acts favourably on the circulation and tone of the hand, and the masseur gently bending the fingers while they are in the water and traction being exerted at the same time, attempts are thus made to restore motion. The patient's voluntary co-operation in making determined active motions is perhaps more useful than any other single measure, and some form of occupational therapy for the hands is very desirable.

In the severe cases, forcible manipulation should never be attempted; it causes great reaction and the results are invariably bad. These and other methods have finally led to the institution of the principle of steady and prolonged finger traction (Figs. 6, 7) which aims at taking a direct pull from the finger tips in the line of the deformity, so as to produce actual separation of joint surfaces, with stretching of adherent capsule and of adhesions in the tendon sheathes: a policy of traction and distraction. The traction should continue in the line of the deformity, until evidence of joint separation is seen by depression of the skin over the knuckles or by the X-rays. The direction of the traction should then be changed, day by day, in the direction of flexion, until at the end of a week or a month, complete flexion is obtained. The traction should be eased several times a day for massage and active motion, and the ability to carry out actively what has been gained passively, is the index for altering the angle of the traction. The treatment should cause no pain or reaction and the traction-pull should

not be too excessive—a pull of 4 oz. separates normal joint surfaces of the fingers. It is interesting to note that although the adhesive tapes cover the intraphalangeal joints, they also share in the traction and increase in flexibility *pari passu* with the metacarpo-phalangeal joints. Fingers mobilised by traction show almost no tendency towards recurrence of the stiffness.

Conclusions.—Disabilities of the hand and wrist form an important group of cases, and their care must be based upon the anatomical data, of which an analysis has been attempted in this paper; which implies especially the employment of more accurate splinting, when immobilisation is necessary, based upon a knowledge of the mechanism of the hand.

Finally, it is suggested once more that what has been said about traumatic conditions, applied equally to all the other affections of the hand and wrist, particularly to the chronic arthritides, in which there is a wide field for the prevention of deformity during the active stage and later for reconstructive surgery.

REFERENCES.—[1] Cotton, *Boston Medical and Surgical Journal*, 4th December 1919. [2] Todd, *British Journal of Surgery*, July 1921, "Fractures of the Carpal Scaphoid." [3] Codman and Chase, *Annals of Surgery*, 1905, pp. 321 and 863. [4] Baldwin, *Orthopædic Surgery of Injuries*, Jones.

DESCRIPTION OF FIGURES.

FIG. 1.—In the first photograph the hand is grasping a large object; in the second, a pen. Their study emphasises the fact that in the opening and closing of the thumb the motion takes place at its basal joint and not at the metacarpo-phalangeal joint.

FIG. 2.—The position of grasp described in the text. Note especially the fully abducted and opposed thumb.

FIG. 3.—The position of full correction after reduction of a Colles' fracture; the so-called Cotton-Loder position.

FIG. 4.—Plaster of Paris splints applied as for Colles' fracture. The cast is split as soon as dry, and with proper care there is no real danger of interference with the circulation of the hand and fingers.

FIG. 5.—A long cock-up splint of desirable shape and form. It is made by applying plaster of Paris strips to the hand, which is carefully held in the position of grasp. When dry, the cast may be shellacked, lined with white felt, and have its edges covered by strips of adhesive plaster. Note the moulding in the region of the hollow of the hand. The splint may be made to weigh only a few ounces.

FIG. 6.—Splint for finger-traction. Plaster of Paris may be used, with incorporation of the rectangular piece of metal illustrated, and is more suitable for fracture of the metacarpals.

FIG. 7.—The direction of the traction has been altered as compared with Fig. 6.

1

2

3

4

6

5

7

AORTITIS, WITH SPECIAL REFERENCE TO SYPHILITIC AORTITIS.*

By S. B. BOYD CAMPBELL, M.C., M.D., F.R.C.P., Assistant Physician, Royal Victoria Hospital, Belfast.

ANY infection may cause aortitis but some do so much more frequently than others. The two most important infections, however, are rheumatic fever and syphilis, the latter being probably much the most common causal factor. Among the causes described in the literature on the subject are the following: — Smallpox, measles, scarlet fever, pneumonia, influenza, typhoid, malaria, and gonorrhœa. Tuberculous aortitis has also been described by Mallory.[1] Most writers on the subject of aortitis are agreed that syphilis is the commonest factor. Thus M'Crea,[2] Anders,[3] Jordan,[4] Bock,[5] Brooks,[6] all lay stress on the great importance of syphilis in the causation of aortitis.

In my series of 37 cases, syphilis was found to be the causal factor in 31 cases. Of these 31, 28 gave a positive Wassermann, and in the remaining 3 a definite history of syphilis was elicited, in 1 twenty years previously, and in the others twenty-six and twenty-seven years. Of the remaining 6, 1 was found in a case of subacute endocarditis, while 2 others gave a definite history of rheumatic fever. Another had lived in the tropics for a long time and had a high blood pressure—220 systolic. The remaining 2 cases gave no definite history of any previous disease.

Age.—The age incidence varies with the cause. As a general rule those due to syphilis are met with in people over 40, while those due to rheumatic or other acute infections in those under 40. M'Crea[2] in his series of 60 cases of dilatation of the aorta, found that 68 per cent. were in people over forty years. Allbutt,[7] Mitchell Bruce,[8] Bock,[5] and Leman,[9] found the average age to be between 40 and 60 years.

In my series of cases the age incidence was as follows :—

	Syphilitic.	Non-Syphilitic.
20 to 29	0	2
30 „ 39	6	2
40 „ 49	16	1
50 „ 59	7	1
60 and over . . .	2	0
	31	6

* Abstract of Thesis presented for the Degree of Doctor of Medicine, University of Edinburgh.

In the syphilitic cases there is considerable divergence in the time which elapses between the primary infection and the onset of symptoms or signs of aortitis. In a great many cases there is probably a long period of latent infection of the aorta, during which no signs or symptoms are to be found. Thus Bock [5] found the average period to be ten years. Mitchell Bruce [8] gives it as twenty-five years. On the other side we find Elliott [10] quoting a case where the aorta ruptured three months after the primary lesions, and Brooks [6] reports a similar case which perforated before the secondary rash had fully disappeared.

In my series of 31 syphilitic cases the following was found :—

Time since infection.	Number of Cases.
Under 10 years	3
10 to 19 years	2
20 „ 29 „	12
30 „ 39 „	3
Denied infection, but Wassermann strongly positive.	11
Total	31

In these 31 cases the duration of symptoms before admission to hospital was :—

Time.	Number of Cases.
1 year or under	9
1 to 2 years	7
2 „ 3 „	8
3 „ 4 „	3
Over 4 years	2

The remaining 2 cases gave no symptoms of aortitis, the condition being discovered during a routine examination at a Pension Board and confirmed later in hospital.

Symptoms.—The early detection of any disease, and more particularly disease of a vital organ such as the aorta, is of the greatest importance. That this early recognition of aortitis has been and still is extremely difficult accounts for the fact that aortic lesions and even aneurisms have often advanced to a considerable degree before the patient's attention has been drawn to the fact that something is wrong. Even when he has complained of symptoms that might have warned the examiner of the possibility of an aortitis, the absence of physical signs to account for the symptoms has obscured the diagnosis. Thus

treatment is often delayed and the opportunity for trying to get rid of the cause and prevent further damage is lost. The slow, insidious spread of the diseased process in the majority of cases accounts for the long lapse of time between the primary infection and the onset of symptoms and the recognition of the physical signs. This slow gradual process is the rule, but there are exceptional cases in which the process is much more rapid when death may occur within a comparatively short time of the initial lesion. Several such cases have already been quoted. In late primary and secondary syphilis, one is constantly finding evidence of cardio-vascular lesions, *i.e.*, signs and symptoms which are similar to those met with in any infection —such as tachycardia, irregularities of the pulse, dyspnœa on exertion, fatigue, etc.

Infection of the heart and aorta takes place in this acute stage, as has been proved by post-mortem evidences of syphilitic lesions. In the majority of cases, however, the early acute infection appears to subside under treatment, but apparently unless such treatment is sufficiently thorough, the spirochætes may remain lurking in the aorta to flare up again at some later date. In one of the cases in my series was a pensioner, aged 28, whom I saw at a Medical Board. All his symptoms were cardiac. He complained of dyspnœa, palpitation, occasional feeling of tightness in the upper chest. He had tachycardia, pulse 130. His effort syndrome was poor. He had a well-marked pseudo-psoriasis skin condition all over his body. His Wassermann reaction was + + with both Fleming and Harrison technique. Examination showed little beyond the tachycardia. He received six injections of novarsenobillon with considerable benefit. His skin condition cleared up completely, and his symptoms, pulse, etc., have improved very much.

In a great many of the old standing cases where the onset has been slow—more especially in the type of person who has had to rough it, and been taught to "work off" slight symptoms —it is often difficult to get a correct history as to what symptom was first in the field, and when and how this symptom first appeared. In my series of cases, a variety of symptoms were described by the patient as the first symptom. With most the history was one of dyspnœa, fatigue, and a severe constriction or pain at upper part of sternum. In some cases there was pain in region of left nipple with an attack of palpitation; in others, pain between the shoulders; while one case stated he

had no complaint except attacks like malaria every two or three months. This man had not served in a malarial zone for about ten or fifteen years.

While these are the symptoms most complained of, the general appearance of the patient was one of the chief characteristics. The majority of cases looked ill and had a peculiar sallow, septic appearance. It was this colour which often drew my attention to the possibility of a syphilitic basis and made me pay special attention to the aortic area. The symptoms met with are very varied though each case usually shows a combination of two or more of the following:— Pain, dyspnœa, palpitation, fatigue, cough, hoarseness, vertigo, lassitude, and depression.

I shall describe these symptoms more fully under their respective headings.

Pain. — There is no symptom in which there is such divergence in degree as in pain. It varies from the merest twinge—often a sense of constriction rather than pain—to the severe alarming condition associated with angina pectoris. To understand this sensation one must mention briefly the various theories brought forward to account for its origin.

The older theories were that the pain arises from distension of an enfeebled ventricle; from spasm of the heart muscle; from intermittent claudication; from myocardial ischæmia; from neural stimulation.

More recently M'Kenzie[11] and Allbutt[12] have advanced theories. The former attributes the pain to a muscular spasm. This theory Stevens[13] disagrees with, as he found extensive lesions of the ventricular wall without any previous symptom of pain. Allbutt attributes the pain to the stretching of the nerve endings in the diseased advential coat of the aorta.

Now of these theories the last appears to be the most feasible from the point of view of an aortitis. Although the myocardium and coronary arteries are involved in certain cases to a varying extent, the common feature in all cases is the involvement of the middle and outer coats of the aorta. The stretching of the sensitive nerve-endings in the outer coat produces painful stimuli, which are conducted to the peripheral nerves, most commonly to those in the region of the upper portion of the sternum, towards the left shoulder, and also down the left arm to the hand, and occasionally down the right arm, to the neck or sometimes to the back.

Pain varies in degree, seat of origin and distribution. In one extreme, it is severe and agonising, so that the patient feels as if he were in a vice. In other cases, pain may be very slight and transient, almost escaping attention. On going carefully into the history of such cases, one finds that the patient when climbing a hill may have to stop for a few seconds, belch some wind, and then continues his journey as if in perfect health.

The usual site of origin is under the sternum, often at the junction of the manubrium and body of the sternum. It may merely be a temporary sense of constriction or compression, the patient complaining of a tightness in the upper part of his chest without actual acute pain. In other cases, the pain may be so severe that the patient has a dread of impending death.

This substernal pain may radiate to the left shoulder or arm or into any of the other paths of distribution already described. In some instances there may be no actual substernal pain, the patient complaining rather of pain in one or both shoulders or in his back—such pain being put down to rheumatism and so the correct diagnosis is often missed. In a few of my cases, the pain originated in the region of the left nipple and was usually accompanied by an attack of palpitation. This form of pain is attributed by some authorities to a myocardial lesion.

The frequency of the attacks and mode of onset varies. Some cases appear to go for relatively long periods free from pain, while others have much more frequent attacks which are brought on by any slight exertion, excitement, or even by some small error in diet. A characteristic feature is the presence of pain at night. Mix[14] states, "when a patient complains of anginal attacks coming on chiefly in the night, we ought not to assume that they are largely due to posture, but ought rather to enquire whether they might not be due to syphilitic aortitis."

Substernal pain which comes on without effort or a predisposing stimulus should always arouse the suspicion of an aortitis. In two of the cases that died while in the Ulster Volunteer Force Hospital, Belfast, this nocturnal pain, accompanied by dyspnœa was very marked.

In certain chronic cases of aortitis without pain to any marked degree, attacks of more acute activity may be accompanied by a corresponding increase in the symptoms. Such symptoms may be cleared up by treatment. A dull ache may be present intermittently for days after an acute attack of pain. The

crises in tabes are attributed by some to a syphilitic aortitis and myocarditis and are considered to be true anginal seizures.

Though syphilis is the most common cause of aortitis and of this pain, especially the substernal type radiating to the shoulders, other conditions may also cause it. Steele[15] describes 2 cases following rheumatic fever where such pain was a prominent feature. In 2 of my cases there was a similar history, but in neither was the pain so marked as in the average syphilitic case. This frequent occurrence of pain in the syphilitic form of aortitis is almost pathognomonic, in fact, Dr Preble[16] states that in a man of 35 or under, pain near the cardiac or aortic area should make one suspect a specific aortitis.

Dyspnœa.—Dyspnœa next to pain is probably the most prominent and most important symptom. Like pain, it varies to a great extent both in its severity and character. Its onset may be gradual, increasing in severity unless antisyphilitic treatment is carried out. The usual history in such a case is that the patient complains of shortness of breath on exertion and inability to perform his daily work as well as formerly. Though this is a common mode of onset, another characteristic one is the sudden acute attack of dyspnœa occurring in a person who had previously no suspicion of any cardiac or respiratory trouble. These attacks may be more marked at night, and are due partly to the aortitis but more to the accompanying specific myocarditis. These attacks of dyspnœa are very characteristic, and according to Mix[17] should always arouse the suspicion of a syphilitic etiology.

Two types of dyspnœa are described by Longhope,[18] one arising on slight exertion and the other paroxysmal in character, the paroxysms coming on at irregular intervals, and usually without any apparent cause.

The dyspnœa does not seem to bear any definite relationship to the severity of the pain. In a typical major anginal attack the dyspnœa may not be marked, for though there is a desire for breath, the patient seems to hold his breath, and the respiratory movements are short and shallow with little quickening of the rate, and not a true dyspnœa. When dyspnœa does occur it appears to be an expiratory one, the chest becoming emphysematous during the attack. In some cases the attacks may simulate a transient but severe asthma.

Allbutt[12] describes the dyspnœa as a slight and retarded

breathing independent of exertion, while Tice[19] states that the condition is an expiratory one, and describes it as the pulmonary type of angina often referred to as air hunger.

This severe type of dyspnœa was always a bad prognostic sign in my series of cases. In the 4 cases that died, severe dyspnœa was one of the most troublesome symptoms, preventing the patients from sleeping. In 3 cases there were definite signs of myocardial deficiency with generalised œdema. In the other case the dyspnœa was not so marked and was more intermittent in character.

The dyspnœa may be due to pressure from a dilated aorta setting up a reflex stimulus; to early cardiac insufficiency; to the irritation of the root of the aorta or to a combination of two or more of these conditions.

The paroxysmal attacks which are asthmatic in character, often end with the expectoration of mucus, sometimes blood stained. One of the cases that died from ulceration of an acute aortitic patch into the bronchus, gave a history of acute attacks of dyspnœa with blood-tinged sputum for some days before it finally terminated in a large hæmoptysis which proved fatal.

The majority of cases in my series showed a much less severe type of dyspnœa. The usual history was that the patient was unable to carry on at his usual job; that it was too heavy for him; that if he exerted himself unduly he became "short of breath." In several this was the first symptom complained of, and for some time the only symptom. As a rule, however, it was accompanied by a feeling of constriction at the root of the neck or by a mild degree of pain. This dyspnœa increases in severity as the disease progresses and may vary in character, becoming more paroxysmal in type. The presence of a positive Wassermann with mild symptoms of dyspnœa or substernal pain should make one treat a case as a specific aortitis even though the physical signs are negligible.

Cough.—Like the other symptoms, also varies in its type and degree. In some cases there may be short, dry, unproductive cough, often worse on lying down at night. In other cases a large amount of sputum may be brought up, and as already stated when speaking of dyspnœa, this sputum may be blood tinged. It is most commonly found in those cases in which definite aneurisms have formed, but it is also got in cases in which there is merely a dilatation of the aorta. The etiology

of the cough is in some cases due to actual pressure in the bronchi; in others, to reflex effect from pressure on the nerves, especially the recurrent pharyngeal. In the latter case the cough is of a husky, clanging, character, and is usually associated with a hoarseness in speaking. In cases where the sputum is blood tinged, the possibility of a leakage from an aneurism has to be remembered.

In my series of cases, cough as a rule was not a prominent symptom, but in 2 of the cases that died there was cough, worse at night, and accompanied by profuse expectoration.

In another case with a definite aneurism, the man's chief complaint was a short, dry, husky cough, present day and night, which prevented him from sleeping. In another case, cough, especially on lying down at night, was very marked, the patient being unable to get any sleep except when well propped up with pillows.

Fatigue.—Is an early indefinite symptom, and may with slight dyspnœa precede the other symptoms by some months especially in the chronic cases. It is more common in those cases which on examination are found to show evidence of aortic regurgitation, and may be due to and accompanying myocarditis.

The patients may be listless and feel a lack of inclination to exert themselves, more than an actual inability to carry out their daily routine. There is a peculiar lassitude and depression which is characteristic in many cases. They seem to fear the worst and they have not a hopeful outlook in life.

Abnormal sweating is sometimes found and, if the condition is accompanied by cough, spit, and slight fever, as often happens, a diagnosis of incipient phthisis may be made, even though there are no physical signs in the lungs to warrant it.

At the Medical Pension Boards, I have seen several pensioners who have been diagnosed as cases of pulmonary tuberculosis, and who had been treated at a sanatorium for this condition, but in whose sputum tubercle bacilli had never been found. On examination, the symptoms and physical signs pointed to an aortitis, and a positive Wassermann helped to confirm the diagnosis. Unfortunately, it is impossible to follow up these cases to see what is the result of treatment.

Temperature.—Another sign which is often a misleading one is the presence of fever. One is very apt to find that syphilis alone may cause an increase in temperature, which may vary from

a daily swing of a degree or so to temperatures of 102° to 103° F., as the case may be.

M'Crea[20] quotes a case with a temperature running from 90° to 104° for five to six weeks, before a diagnosis of syphilis was made, though once antisyphilitic treatment was started the temperature soon became normal. Stengel[21] describes febrile attacks in cases of acute aortitis.

One case in my series gave a history of intermittent febrile attacks. These disappeared entirely on treatment.

Vertigo.—The importance of vertigo as a symptom depends largely on its cause. It is a common symptom in neurasthenics and in dyspeptics, especially after stooping. Its origin may be central or peripheral, in the latter cases usually aural.[17] A common cause of vertigo is syphilitic involvement of the cerebral arteries and of the cerebellar arteries in the more severe cases.[22] In 6 of my cases vertigo was a prominent symptom, being described as a giddiness, a dizziness, or a lightness in the head. In one case it was actually so severe as to cause the patient to fall to the ground. In all cases it was looked on by the patient as one of the most serious symptoms of his complaint, and its presence invariably increased the dread which this type of case usually presents.

There are several other symptoms found in certain cases, but usually to a less marked degree. Palpitation sometimes causes considerable annoyance to the patient. Flatulence, indigestion, and other abdominal conditions may be complained of. General weakness, vague neurasthenic symptoms, mental fatigue, headaches, etc., may all be discovered, and may be simply part of the general syphilitic infection, as each or all of them may be found in a secondary infection.

Physical Signs.—Important as symptoms are, and in the early cases, they are often all that we have to base our diagnosis on, physical signs must be carefully looked for, so that we may find some evidences of a pathological change which could account for the symptoms complained of, and which, when all the facts and findings are put together, enable us to make a definite diagnosis at as early a stage as possible, and thus give therapeutic measures a reasonable chance of success.

Of the physical signs to be looked for some are more or less general to several forms of cardiac disease, while others, especially if two or three of them are found together, are characteristic of an aortitis.

In dealing with these physical signs, I shall first of all discuss those that can be seen on inspection before going on to those made out by palpitation, percussion, auscultation, etc.

One of the most striking features, in my opinion, of a syphilitic aortitis, is the general appearance of the patient, especially the peculiar colour of the skin, generalised to a certain extent but most marked on the face. This colour was, as a rule, of a yellow, sallow character, but in some the sallow tinge was not so marked and the colour was more of an earthy grey nature. This change in complexion was found in most of my syphilitic cases, and in several cases led me to be on the lookout for an aortitis.

Herbert[23] found that 70 per cent. of his cases showed this characteristic colour—pale grey, with often a yellowish or brownish tint.

In some cases, this change in the complexion may be accompanied by a falling out of the hair. The whole aspect of the patients makes them look ill. Whether this condition is part of a generalised syphilis or whether it is confined to cases with involvement of the cardio-vascular system, is not important, in view of the recent work in the pathology of syphilis by Warthim.[30] He found spirochætes in the heart and aorta in a large percentage of syphilitic cases. Undoubtedly the response to treatment is usually shown first by a clearing of the complexion in addition to an abatement of the symptoms.

Another abnormality detected on inspection is a fullness in the neck and a dilatation of the veins in the neck, arms, and about the shoulders. This is nearly always due to some obstruction of the superior vena cava, or some of its main branches. A common cause of the obstruction is pressure from an aneurism or a dilated aorta. In certain cases, however, the pressure may arise from a gumma or some syphilitic mediastinal condition which is present in addition to the specific aortitis. Back pressure from the right auricle may in some cases cause, in others augment, the dilation of the veins.

Pulsations.—Either thoracic or in the vessels of the neck, are other important physical signs. To look for these, the patient should be naked to the waist with a good light falling on the front of his chest, and inspection carried out from different angles. It is often a good plan to get the eyes on a level with the chest wall, with the patient lying flat on his back in bed. Pulsation to an abnormal degree may be seen in the carotids.

Here it is due in some cases to the aortic incompetence so frequently found in aortitis, but in other cases it is due to a tortuosity of the carotids caused by their point of origin being somewhat higher than normal, and in consequence they are displaced.

The subclavians also may show abnormal pulsations for similar causes to those in the carotids. In cases of aortitis, especially with marked dilatation, the subclavians may be pushed upwards, being visible above the clavicles. This apparent elongation of the aorta is also responsible for another type of pulsation, and one which is characteristic of an aortitis, namely, pulsation in the episternal notch. In marked cases the aorta may be visible above the sternum as a definite pulsating tumour. This was seen in one of my series.

On the anterior aspect of the chest pulsations may be got in the first or second interspaces, either on the right or the left side, or in all of those spaces. The second right interspace is the most common site of pulsation, then the second left, first right, first left, in this order.

Normally, pulsation may be got in the second left interspace, but extensive pulsation at the upper end of the sternum usually means an aortitis with or without an aneurism.

Palpation.—The physical signs detected on palpation are very similar to those seen on inspection. Pulsations in the neck, sternal area, etc., can be felt, though in many cases they are better seen. Tortuosity or abnormal position of the subclavian or carotids may be found. One of the most important findings, however, is the palpation of the aorta in the suprasternal notch.

Usually the arch of the aorta cannot be felt in the suprasternal notch, but is generally 2 to 2½ cm. below it. It may be palpated in cases of high blood pressure, as well as in aortitis. In acute aortitis it is often tender to the touch.

In addition to pulsation in the first and second right or first and second left spaces, a shock, diastolic in time, or a thrill, also usually diastolic, can often be felt. If there is a definite dilatation of the aorta this diastolic shock is usually well marked. A systolic thrill is, however, diagnostic, not of a dilatation of the aorta, but of a stenosis of the aortic valve.

The position of the apex beat and the question of its mobility on change of position should also be gone into. In cases where in addition to the dilatation there is an elongation

of the arch, one may find that the apex beat moves on change of position to a much greater extent than normal. In cases where a pulsating tumour is visible, palpation helps to differentiate between an aneurism with its expansile pulsation and the transmitted pulsation got in a mass lying over the aorta. In aortitis the two most important signs in palpation are the diastolic shock and the suprasternal pulsation.

Percussion also gives considerable assistance in arriving at a diagnosis, chiefly by estimating the extent of the aortic dullness at the upper end of the sternum.

Normally, the aorta in men should measure from 5 to 7 cm., and over fifty years about 8 cm.; in women a little less. In aortitis the general rule is to get an increase in this measurement, which increase in syphilitic cases rarely shows any diminution under treatment, whereas in cases due to some acute infection such as rheumatism there is a tendency to recession as the disease subsides.

The increase in width naturally varies from a small degree to cases where the aortic dullness may measure as much as 14 cm. This dullness may be more marked on one side of the sternum than on the other, and usually extends upwards towards the suprasternal notch. The commonest site is in the second right interspace, and here the dullness is much more diagnostic of aortitis than, say, in the second left interspace. Dullness on percussion over the manubrium is also a useful help in diagnosis. M'Crea[2] found that in 55 of his cases this dullness was present.

The size of the heart and the position of the apex beat have also to be determined. It is often difficult to do this with accuracy by percussion on account of the depression of the apex beat in cases where the aorta is elongated as well as dilated. One case who died and on whom a post-mortem was made, was found to have a small heart with a large dilated aorta, though the clinical findings gave the position of the apex beat as the sixth space, almost in the nipple-line. The occurrence of a large hypertrophied heart is not so common in cases of syphilitic regurgitation as in those cases due to some other infection.

In some of my cases the heart appeared to be enlarged, as the apex beat was found in the sixth interspace in or outside the nipple-line. On X-ray examination this was found to be due to a dilated aorta, the heart being normal in

size but pushed down by the aortic condition. In most of my cases the apex beat was normal in position.

Auscultation.—The changes found on auscultation vary to a certain extent in individual cases, but there are two fairly characteristic findings. Usually the first change met with is a peculiar quality of the second aortic sound, described by some as a clanging sound, by others as a *brûit de tabourka.* It varies to a certain extent in the same individual, some days being much more marked than on others, and though it usually retains the peculiar quality there may also be slight variations in this. When found, it should always make one suspect a specific aortitis, though it is not diagnostic of this condition, being sometimes found in cases associated with high blood pressure, as in certain cases of Bright's disease, or in the other form of aortitis due to some non-venereal infection.

This peculiar second sound may be accompanied by a diastolic bruit without losing its clanging quality. In the early cases the bruit is very difficult to detect and may only be audible when the patient holds his breath, or it may be brought out by exercise. It is often accompanied by a systolic bruit—in fact this systolic bruit may precede the diastolic for a considerable time.

As the disease advances and a definite pathological regurgitation takes place at the aortic orifice, the physical signs become more definite. On auscultation, one now finds a definite double aortic bruit; the diastolic one especially being well marked and still, as a rule, having that clanging quality already described.

Allbutt[24] describes a chafing sound due to a dry, basic pericarditis, which is sometimes found along with an aortitis. One of my cases, a pensioner aged 30, had this chafing sound associated with a double aortic bruit.

A well-marked diastolic bruit usually means a definite and pathological insufficiency. It was formerly supposed that this insufficiency was a relative one, but recent investigations have proved it to be a true deficiency due to the involvement of the valves by the spirochætes. Syphilis always acts as a dilator, and according to Mix[14] there is no such thing as a syphilitic stenosis. Anders,[3] Longhope,[25, 18], M'Ilwaine,[26] Libmann,[27] all emphasise the frequency with which aortic insufficiency is associated with syphilitic aortitis. The report of Russell Wells[28] is in marked contrast to their finding and to those in my own series.

Pulse.—In chronic cases of aortitis with no myocardial complications, the pulse as a rule shows no deviation from the normal. From an aortic standpoint the only changes are those found when there is an aneurism present with a difference in the two pulses.

Even when aortic incompetence is present the pulse is not necessarily of the typical water-hammer type. In many cases it is not so "bounding."

In secondary syphilis the pulse may be intermittent, show extra systoles, or other disturbances in rhythm. It is often increased in rate. In the older, more chronic syphilis, with definite aortic changes, the presence of an arhythmia is usually a serious sign, pointing to definite myocardial change, and is often the preliminary sign to definite failure of compensation. A few cases in my series showed these changes; cases 13 and 27, both of whom died, had increased pulse rates with an irregular rhythm. Even in cases with well-marked aneurisms only very slight changes in the two pulses were felt, and these changes were chiefly in the volume of the pulse. There were no appreciable differences in the rate.

Blood Pressure.—Here again one finds practically no characteristic change; as a rule the blood pressure is not raised, or if raised, is only to a very moderate degree.

Cases complicated by renal disease or generalised arterio-sclerotic changes show an increase in the blood pressure, but without these complications any such increase is unusual.

The average blood pressure in my series was between 130 and 140. The only cases with a really high blood pressure were one with 220 systolic and 180 diastolic—a patient who gave no history of syphilis and whose Wassermann was negative; and another, aged 55, with a history of syphilis thirty years previously and a positive Wassermann, also had a pressure of 220 systolic and 80 diastolic.

Wassermann Reaction.—Of the newer methods of examination the Wassermann test has given us a very efficient means of arriving at a diagnosis of the etiology of many cases of aortitis. Unfortunately, however, a negative Wassermann does not exclude syphilis. If definite symptoms and signs of aortitis are present, in the absence of a history of rheumatic fever or some other acute infection, antisyphilitic treatment should be carried out even though the Wassermann test is negative. The routine examination and newer methods of treatment of syphilis are

not of sufficiently long duration to enable us to arrive at a correct estimate of the benefit of this test from a therapeutic standpoint. In many cases in which vigorous antisyphilitic treatment has been carried out over a long period one fails to get the blood negative.

In my series of 37 cases, 31, or 83 per cent., gave either a definite history of syphilis or a positive Wassermann. 28, or 75·6 per cent., gave a positive Wassermann. The test was of great value in determining the syphilitic factor, as a good many of the patients denied having had syphilis till confronted with the positive result. Then, as a general rule, they gave the time of infection and history as regards previous treatment.

X-ray Examinations.—However much one may suspect a lesion in the aorta, a definite diagnosis of its extent, exact position and nature can often not be made until an X-ray photograph of the heart and aorta is taken. By the methods of examination already described, we may find all the signs and symptoms of an aortitis, but by them alone in the early stages we are unable to say whether an aneurism is forming or whether there is general dilatation of the aorta.

Tice [19] describes three main types of syphilitic aortitis from the standpoint of the skiagraph. In the first there is obliteration of the aorta knob due to dilatation of the aorta, or because of the filling of the space between the knob and the heart the shadow becomes continuous. The second shows an increase of the aortic shadow to the right, especially in cases where there is no increase in the cardiac shadow. The aortic shadow extends further to the right than the right border of the heart. When this occurs, it indicates a dilatation of the arch of the aorta. Thirdly, there is a uniform dilatation of the shadow—that is, there is a definite increase to the right and left of the aortic shadow. In addition to these three types described by Tice, there are the numerous varieties of aneurisms which often cannot be definitely diagnosed without the aid of skiagram. From a general standpoint we should look for alterations in the density of the shadow and a change in the contour.

Prognosis.—The prognosis in aortitis depends on the situation of the lesion, on the occurrence of aneurisms and what form they take, and on the presence of complications. The unfavourable signs are the occurrence of aortic incompetence, and of myocardial changes. Cases of syphilitic

aortic incompetence as a rule died within one to five years after a diagnosis had been made.

Herbert[23] states that 48 of his cases died on an average of from twelve to fifteen months after the disease was discovered.

Three of my series who died had only complained of cardiac trouble for about one year, and had been under medical care for a somewhat shorter period than this. Aortic incompetence cases from some acute infection such as rheumatic fever, once the disease has subsided, seemed to live for a considerably longer period than this. I know of two such patients, one of whom was found to be suffering from aortic incompetence twenty years ago. He led an active, vigorous life till a few months before his death at the age of seventy-five. The other case has also had aortic disease for many years, and is still alive and taking an active part both in his work and in sport. Cases like this do not occur in the syphilitic form of aortic incompetence.

Myocardial disease, especially when it shows evidence of failing compensation is a very serious prognostic sign. It is a common sequel to the incompetence. Recent work on the pathology of syphilis has shown that the myocardium is very frequently involved in this disease. When this causes a failure of compensation the outlook is bad. The usual signs one gets are changes in the pulse, œdema, severe dyspnœa.

In aneurisms the prognosis depends on the situation, the liability to rupture, and, in many cases, on the size. A small aneurism is much more liable to rupture than an old standing large aneurism, which has adhesions to keep in its support. The site of perforation has already been gone into under aneurism.

The prognosis materially depends on the amount of treatment given. If the actual disease has been checked, and can be kept under control, there is less chance of the dangerous signs and symptoms appearing.

Treatment is mainly on antisyphilitic lines, to try to limit the lesion and prevent further damage to the aorta and the heart muscle. The damage already done is permanent, and one cannot hope for a dilated aorta or a sclerosed valve to resume its normal shape and size. Rest is an essential factor at first.

MacLachlan[29] considers that all cases showing evidence of

aneurism should rest in bed for three months and limit their exercise for another nine months.

In any case, even with no evidence of aneurism, where there is evidence of myocardial defect rest is of the utmost importance. A few weeks in bed even without very active treatment will effect definite improvement in the symptoms.

If œdema and severe dyspnœa are present, a bed rest is usually required, as without it sleep is often impossible.

Medicinal treatment resolves itself into that required to combat certain symptoms that arise and the more definite anti-syphilitic treatment. In the former, the usual cardiac tonics, diaphoretics, hypnotics, etc., may be tried. Morphia may be indicated in severe cases of dyspnœa or pain.

Of the antisyphilitic remedies, we have three main stand-bys, mercury, iodides, and one or other of the arsenical compounds. Potassium iodide should be given in doses of 10 to 15 or more grains three times a day. It helps to relieve the symptoms and to absorb any gummatous lesions that may be present, but, according to MacLachlan and others, it has no action on the spirochætes. On this account it should always be accompanied by mercury, administered either by inunction, intramuscular injection, or by the mouth.

The usual arsenical compound used in my series was novarsenobillon. The patients were given two doses of 0·3 gram, then six doses of 0·45 gram at intervals of a week. In practically every case there was a marked improvement after this course of injections. The first change noticed was in the complexion. The yellow or greyish look was lost and the patients looked much better. The symptoms improved, and the patients put on weight, and in every way there was a change for the better. Physical signs in the aorta did not alter, and in no case did the Wassermann reaction become negative, even after the patient had had two or three courses of injections. The patients could not be kept on indefinitely in the hospital, but on discharge they were all instructed to attend at one of the V.D. clinics for further treatment.

Dr Preble[16] recommends that the arsenical compound should be given in smaller doses at an interval of a few days. He usually starts with 1 milligram. MacLachlan recommends twelve injections, six of 0·2 gram and six of 0·3 gram.

In using the larger doses I never experienced any bad effects.

REFERENCES.—[1] Mallory, *Principles of Path. Histology*, W. B. Saunders & Co. [2] M'Crea, *Amer. Journ. Med. Sci.*, October 1910. [3] Anders, *Amer. Journ. Med. Sci.*, October 1915. [4] Jordan, *Lancet*, 21st February 1903. [5] Bock, J., *Medical Science Abstracts and Reviews*, vol. cxi., No. 3. [6] Brooks, *Amer. Journ. Med. Sci.*, 1913, vol. cxlvi. [7] Allbutt, *St George's Hosp. Rep.*, 1969. [8] Mitchell Bruce, *Lancet*, 8th July 1911. [9] Lemann, *Amer. Journ. Med. Sci.*, 1916, vol. cl., p. 210. [10] Elliot, *Medical Clinics of North America*, vol. i., p. 1305. [11] M'Kenzie, *Oxford Loose Leaf*, vol. ii. [12] Allbutt, *Lancet*, 18th July 1903. [13] Stevens, *Medical Clinics of North America*, vol. i., p. 293. [14] Mix, *Medical Clinics of Chicago*, vol. i., No. 5. [15] Steele, *Lancet*, 21st November 1903. [16] Preble, *Medical Clinics of Chicago*, vol. i., p. 319. [17] Mix, *Medical Clinics of Chicago*, vol ii., p. 1017. [18] Longhope, *Arch. Int. Med.*, 15th January 1913, vol. xl. [19] Tice, *Medical Clinics of Chicago*, vol. i., p. 147. [20] M'Crea, *Medical Clinics of North America*, vol. i., No. 2. [21] Stengel, *Brit. Med. Journ.*, 20th October 1906. [22] Cabot, *Differential Diagnosis*, vol. ii., W. B. Saunders & Co. [23] Herbert, *Medical Abstract and Reviews*, vol. i., No. 1. [24] Allbutt, *Diseases of Arteries, including Angina Pectoris*, 2 vols., MacMillan & Co. [25] Longhope, *Journ. Amer. Med. Assoc.*, vol. liv., No. 2. [26] M'Ilwaine, *Brit. Med. Journ.*, 27th March 1920. [27] Libmann, *Medical Clinics of North America*, vol. i., p. 573. [28] Russell Wells, *Brit. Med. Journ.*, 29th May 1920. [29] MacLachlan, *Amer. Journ. Med. Sci.*, 1920, vol. clix. [30] Warthin, *Amer. Journ. of Syphilis*, vol. i., No. 4.

VARIATIONS IN RESPIRATORY EXCHANGE WITH MASKS OF DIFFERENT TYPES.

By LUCIEN DAUTREBANDE, M.D., Louvain, and H. WHITRIDGE DAVIES, M.B., B.S., Adelaide.

(*From the Department of Therapeutics, University of Edinburgh.*)

DAVIES, Haldane, and Priestley[1] have pointed out the effects of resistance upon respiration. The first response of the respiratory centre to resistance is a slowing and deepening of respiratory movements and an increase in the alveolar carbon dioxide percentage. The respiration adapts itself to the new conditions. If, however, the resistance is excessive, the respiratory centre becomes more and more fatigued, and after a time respiration becomes shallow and frequent, and symptoms of asphyxia develop. Moreover, this asphyxia, as might be expected, is responsible for the great rapidity with which the respiratory centre, under the influence of resistance, manifests its fatigue. Further, Haldane, Meakins, and Priestley[2] have shown conclusively the harmful effect of shallow breathing on the oxygenation of the blood, and concluded that it caused an anoxæmia which was followed by further shallow breathing—hence a vicious circle. This occurs whether the original cause be either functional or organic. The same may be due to resistance. (Resistance may be taken to include weakness of the muscles of respiration.) If this vicious circle be not broken by immediate intervention the respiratory centre becomes more and more fatigued, respiration is jammed, and death results from failure of the respiratory centre.

The favourable effect of oxygen in cases of anoxæmia is well known. Haldane, Meakins, and Priestley cut short the anoxæmia of shallow breathing by administering oxygen at a rate of two to four litres per minute. Meakins[3] describes the great value of oxygen in the anoxæmia of pneumonia. Anoxæmia due to asphyxial gases and their nervous and pulmonary sequelæ is relieved in the same way by oxygen. The less the disturbance caused by the means of administration, the greater is the beneficial effect of the increased oxygen concentration.

One question, we believe, which has not been investigated in the more and more frequent therapeutic use of oxygen,

and in determination of the respiratory exchange, is the influence of various types of mask on normal respiration and during the inhalation of varying concentrations of oxygen. In order to obtain an accurate measure of gaseous metabolism, it is obvious that the necessary apparatus must be such as to cause the minimum disturbance of normal respiration. Any increase of variable dead space or interposition of resistance will have variable effects on the alveolar carbon dioxide, and thus indirectly upon pulmonary ventilation. Even when the resistance is nil and the mask perfectly comfortable, the alveolar carbon dioxide must tend to increase with the increase of dead space. If there be a slight resistance the alveolar carbon dioxide will be still further increased. Some subjects, however, may react to the discomfort of a slight resistance by a certain degree of over-ventilation and consequent fall of the alveolar carbon dioxide pressure. This unusual response of the respiratory centre to slight resistance may be the first stage of fatigue with its resulting rapid shallow breathing and anoxæmia. Men who are unable to tolerate the box respirator, even during rest, probably belong to this category.

Our observations have been made with four types of appliance:—

(1) **The Haldane oxygen administration mask** (referred to as Haldane mask) has been previously described in detail.[11] It consists of a metal body with pneumatic rubber face-piece. There is a free opening to the outside air and an inlet for the oxygen with a valve so arranged that during expiration oxygen is conserved in a small collapsible bag.

(2) **The modified Haldane mask.** This is of the same general type as (1). If, however, one desires to collect the expired air of a subject, it is necessary to introduce some form of valve circuit which permits inspiration of room air and expiration into a bag. Professor Meakins, after trying many different arrangements, finally adopted the type shown in a detailed diagram in Fig. 1. These masks were made under the supervision of Professor Briggs in the Edinburgh Laboratory of the Oxygen Research Committee of the Department of Scientific and Industrial Research. A (Fig. 1.) is the body of the mask, made of thin sheet metal. B is the pneumatic rubber face-piece, inflated at F. C is the inspiratory valve, placed so as to close during expiration, the dotted line showing the remainder of the valve on the inside of the mask.

D is the expiratory tube to which may be attached the flexible tube leading to a Douglas bag or spirometer. E contains the expiratory valve placed so as to close during inspiration and so prevent re-breathing. G is the elastic band which fastens at the back of the subject's head. The valves are of rubber and of the Rosling type but rather smaller than those usually supplied by Messrs Siebe, Gorman, & Co., Ltd. The detail

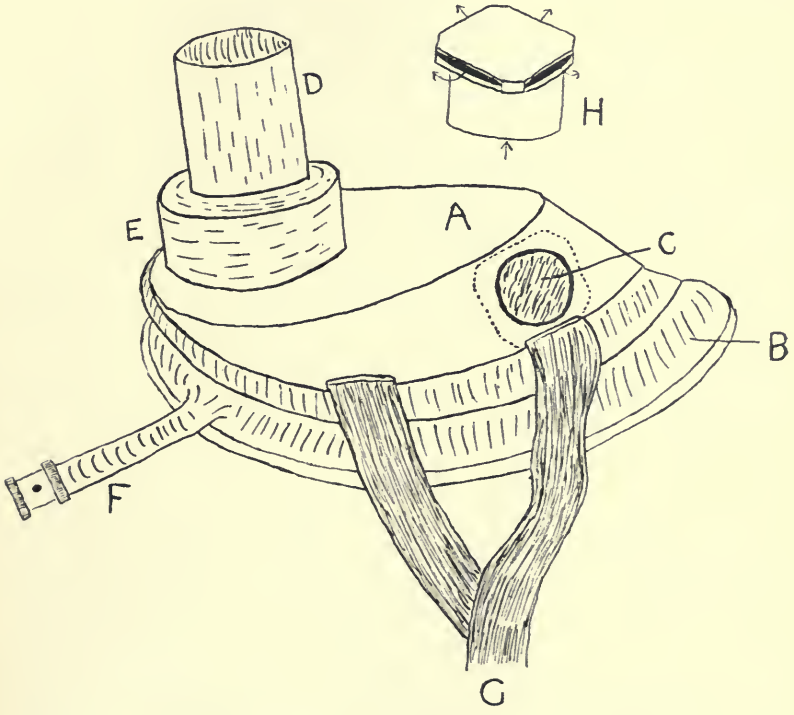


FIG. 1.—Haldane Mask modified for the Collection of Expired Air.
For details see text.

of these valves is shown in Fig. 1. (H), the air passing in the direction of the arrows. Professor Briggs has recently devised a simpler valve which seems to possess distinct advantages, but we have not yet had an opportunity of testing it.

(3) **Rosling valve set** (referred to as Rosling valves with mouth-piece). These have previously been described in detail by Raper.[10] A nose-clip is necessary with this appliance.

(4) **Sponge rubber mask with Rosling valves.** This consists of a rubber mask with a single opening to which is

attached a Rosling valve set. The inside of the mask is lined with spongy rubber moulded to the face. We have found that with many subjects this moulding does not adapt itself and leaks occur.

TABLE I.

Subject	L. D.	H. W. D.	C. R. H.	J. C. M.	
Dates	26.5.21 27.5.21 28.5.21	30.5.21 31.5.21 10.8.21	17.6.21 18.6.21	20.6.21 23.6.21	
Conditions.	**Alveolar Carbon Dioxide percentage.**				**Remarks.**
Normal	5·91	5·85	5·51	5·76	.....
Haldane mask, without oxygen	5·91	5·72	5·63	5·78	.....
Haldane mask, with oxygen	5·69	5·56	5·33	5·62	3 litres of oxygen, per minute.
Rosling valves, without oxygen	6·26	5·64	5·81	5·53	.....
Rosling valves, with oxygen	6·08	5·39	5·69	4·70	30 litres of oxygen, with 70 litres of air.
Sponge rubber masks, and Rosling valves, without oxygen	5·85	5·68	5·23	...	.....
Sponge rubber masks, and Rosling valves, with oxygen	5·89	5·57	5·37	...	30 litres of oxygen, with 70 litres of air.

The experiments summarised in Table I. were undertaken on four subjects who are accustomed to the Haldane-Priestley[9] method for collecting samples of alveolar air. The subject rested comfortably in an arm-chair for quarter of an hour before, and during the experiment, which was performed usually between 10 A.M. and 6 P.M. Between each experiment with a different mask additional samples of alveolar air were collected after allowing time for the respirations to return to normal, so that the slight variations due to meals, etc., could be eliminated. Each figure in Table I. represents the mean of at least one inspiratory and one expiratory sample. In the majority of the experiments the figures represent the average for a number of pairs of samples. The duration of each experiment with every mask was from fifteen to twenty minutes whether with ordinary air or with oxygen. As can be seen, the susceptibility to slight resistance may vary greatly with different individuals. Some react by considerable over-ventilation while others may remain unaffected by the same type of mask. This may to some

extent depend upon the manner in which the mask adapts itself to the face, and also upon the discomfort of the nose-clip (Rosling valve set). The most important practical conclusion from our experiments is that the Haldane mask (as supplied with the field pattern oxygen apparatus) causes least disturbance of normal respiration. Its resistance is practically negligible. The easy adaptation of the pneumatic rubber face-piece makes it comfortable while permitting normal respiration through the nose.

Dautrebande and Haldane[4] have shown that breathing pure oxygen increases the carbon dioxide tension in the respiratory centre by slowing the circulation, presumably by vaso-constriction. The slowing of the pulse is a sign of this. The slowing of the circulation causes a tendency to an increased carbon dioxide tension in the respiratory centre. The centre will not tolerate this and responds by increasing the pulmonary ventilation, thus lowering the alveolar carbon dioxide pressure. This mechanism is the response of the organism against the well-known toxic effect, originally described by Paul Bert[12] of excessive oxygen tension upon the nervous centres. Table I. shows that this occurs not only with pure oxygen but with percentages of oxygen scarcely double that of atmospheric air. In every subject the pulse was slowed by five to eight beats per minute during the respiration of oxygen.

The above observations have a clinical bearing. Estimations of the basal metabolic rate are becoming of considerable importance, and for results to be of value, the determinations need to be made with very careful attention to numerous details. It is important that in collecting the sample of expired air, the respirations should be disturbed as little as possible. A large number of basal metabolic determinations have been made in the clinic of Professor Meakins, at the Royal Infirmary, Edinburgh. The samples of expired air were collected in a Douglas bag[8] by means of the modified Haldane oxygen mask described above. This simple method gives highly satisfactory results and the close agreement of duplicate determinations is shown in Table II. (experiments 1 and 4).

From the results in Table I. it was evident from the variations in the alveolar carbon dioxide tension that the quantity of expired air, its percentage of carbon dioxide and oxygen, and the number of calories per hour and per unit of surface would show considerable variation according to

TABLE II.

H. W. D. 30.8.21. Height 179·3 cms. Weight 73·7 kg. Surface (Dubois chart) 1·93 square metres. Age 27. Ten minute periods. Post-absorptive condition. Normal for age 39·5 calories per square metre per hour. Subject rested for half hour before commencement and between each experiment.

Apparatus Used.	Time of Period, Pulse and Respiration before and during Period.	CO_2 % in Expired Air.	O_2 % in Expired Air.	O_2 % taken up.	R. Q.	Expired Air Litres in ten minutes.	Calories per hour.	Calories per square metre per hour.	Basal Metabolic Rate.
1. Haldane mask (modified form)	10.23 to 10.33 A.M. R. 13, 13, 13, 13 P. 60, 60, 60, 59	3·35	17·08	3·99	0·83	60·25	65·7	34·0	− 13 %
2. Rosling valve, mouthpiece with nose-clip .	11.20 to 11.30 A.M. R. 11, 11, 13, 15, 15 P. 60, 60, 59, 60	4·08	16·47	4·58	0·88	54·8	69·5	36·0	− 8 %
3. Sponge rubber mask with Rosling valves . .	11.51 to 12.1 P.M. R. 15, 15, 13, 14, 13 P. 60, 60, 60, 60, 60	3·88	16·73	4·29	0·89	53·3	63·5	32·9	− 16 %
4. Haldane mask (repeated)	12.41 to 12.51 P.M. R. 14, 13, 13, 13 P. 59, 56, 58, 58	3·40	17·08	3·98	0·84	60·1	65·6	34·0	− 13 %

whichever type of mask were used. Thus the basal metabolic rate would vary in a similar manner.

One of us (H. W. D.) was the subject of the experiments summarised in Table II. With the Rosling valve set and with the sponge-rubber mask, the carbon dioxide percentage in the expired air was increased, although with the same appliances his alveolar carbon dioxide percentage was shown previously to be slightly below that obtained while wearing the Haldane mask. The respiratory quotient (0·83 with Haldane mask) rose to 0·88 (Rosling valves) and 0·89 (Rosling valves with face-mask). From consideration of the alveolar carbon dioxide percentage and the respiratory quotient for the latter two appliances one would conclude that the subject was over-ventilation. This is not so, because the quantity of expired air in experiments 2 and 3 is considerably diminished. On the other hand, conversely to what happens in over-ventilation, the percentage of oxygen taken up from the inspired air is considerably increased. If, however, we calculate the physiological dead space for each of these masks a probable explanation suggests itself. The physiological dead space calculated for the Haldane mask, according to the formula of Douglas and Haldane[5] (dead space = volume of each breath − volume of each breath × percentage of carbon dioxide in expired air ÷ percentage of carbon dioxide in alveolar air) is 193 c.c. If we deduct about 40 c.c. for the external dead space of the mask itself we have a dead space of 153 c.c. By a similar calculation we have a dead space of 64 c.c. for the Rosling valves, and 70 c.c. for the sponge-rubber mask. Thus, as a result of the resistance of the masks in experiments 2 and 3, the physiological dead space of H. W. D. for carbon dioxide is diminished. A similar diminution must occur in the dead space for oxygen. Hence we can explain the greater percentage of oxygen taken up and the greater percentage of carbon dioxide in the expired air. Moreover, the physiological dead space being diminished, the percentage of expired carbon dioxide, or, in other words, the total carbon dioxide in the respiratory tract, must tend more and more to approximate to the value of the alveolar carbon dioxide. The air in the lungs thus having a greater effective space, the alveolar carbon dioxide must slightly diminish, otherwise there would be a corresponding slight rise in the carbon dioxide of the arterial blood to which the respiratory centre would respond

by over-ventilation. Table II. shows that there was no over-ventilation.

The different values for the respiratory quotient can be explained in the same manner. We cannot expect the oxygen taken up to increase correspondingly to the increase of expired carbon dioxide, for it has been shown by Haldane[7] and by Yandell Henderson and his fellow-workers[6] that the physiological dead space for oxygen is greater than for carbon dioxide, hence the higher value for respiratory quotient in experiments 2 and 3. We do not consider that these variations indicate any fundamental change in the body metabolism, but are spurious variations and only due to the apparatus. The values obtained with the modified Haldane mask approximate most closely to the generally accepted value for fasting individuals.

We would draw attention to the irregularity of the respirations in experiments 2 and 3 (Table II.). We have made further observations and have obtained similar results for another subject.

It is apparent from these tables that with the Haldane mask the respiration most nearly approximates to normal, and that estimations of basal metabolic rate may be vitiated by masks which cause even slight resistance or discomfort; and further, the method used by us for clinical determinations of basal metabolic rate give results which are very consistent. A second sample of expired air from the same subject under the same conditions two and a half hours after the first gave identical results. The slightly increased metabolic rate in experiment 2 (Table II.) was probably due to the slight discomfort associated with the Roslin valve set, while the diminished rate in experiment 3 may have been due to a slight leak, a factor which is difficult to avoid in some subjects with Rosling valves and face-piece.

Summary.—1. Under the influence of resistance caused by certain types of mask, the alveolar carbon dioxide may vary considerably. Different subjects may not respond in the same manner to the resistance or discomfort of the same mask.

2. The modified Haldane mask is the one which in our experience permits the respirations to approach most nearly to the normal.

3. Not only with pure oxygen but also when the oxygen percentage of inspired air is scarcely double that of atmospheric air, the alveolar carbon dioxide is diminished as a result of

increased pulmonary ventilation, also the pulse rate is diminished. These facts introduce a possible physiological source of error into methods for estimating basal metabolism in which the subject breathes either pure oxygen or air enriched with oxygen.

4. Estimations of basal metabolic rate with the modified Haldane mask and Douglas bag give results which are extremely consistent.

REFERENCES.—[1] Davies, Haldane, and Priestley, *Journ. of Physiol.*, vol. liii., p. 60, 1919. [2] Haldane, Meakins, and Priestley, *Journ. of Physiol.*, vol. lii., p. 433, 1919. [3] Meakins, *Journ. of Path. and Bact.*, vol. xxiv., p. 79, 1921. [4] Dautrebande and Haldane, *Journ. of Physiol.*, vol. lv., p. 296, 1921. [5] Douglas and Haldane, *Journ. of Physiol.*, vol. xlv., p. 231, 1912. [6] Yandell Henderson *et al.*, *Amer. Journ. of Physiol.*, vol. xxxviii., p. 1, 1915. [7] Haldane, *Amer. Journ. of Physiol.*, vol. xxxviii., p. 20, 1915. [8] Douglas, *Journ. of Physiol.*, Proceedings of Physiological Society, 1911, vol. xlii., p. 17. [9] Haldane and Priestley, *Journ. of Physiol.*, vol. xxxii., p. 225, 1905. [10] Raper, *Journ. of Physiol.*, Proceedings of Physiological Society, vol. liii., p. 112, 1920. [11] Haldane, *Brit. Med. Journ.*, 10th Feb. 1917. [12] Paul Bert, *La Pression Barometrique*, Paris, 1878.

NOTE.—Since the above was written one of us (H. W. D.) has had opportunities of using a new type of mask devised and manufactured in the workshops of Messrs Siebe, Gorman & Co., Ltd. It consists of a body made of malleable copper which can readily be bent and shaped to fit any face. It is covered with rubber and has a pneumatic rubber edge ensuring absence of leaks. There are separate inspiratory and expiratory channels, fitted with Rosling valves which can be obtained of the small light variety described above. This appliance appears to possess all the advantages which we have claimed for the modified Haldane mask, and further, it has the advantage of being able to be moulded to fit faces where one occasionally has difficulty with the Haldane mask. Also it can be obtained in two sizes.

THE URETHROSCOPE AS AN AID IN THE DIAGNOSIS AND TREATMENT OF GONORRHŒA.

By CECIL C. BROWN, M.D., D.P.H., Assistant Clinical Venereal Diseases Officer to the Corporation of Edinburgh.

(*Continued from page* 64.)

Rare Pathological Conditions met with—(a) *Polypi.*—The mucosa of the urethra, as that in other parts of the body, is subject to the development of granulations, polypi, and other hypertrophic changes following prolonged inflammation.

Granulations occur more frequently in the posterior urethra, especially in the prostatic portion. They are commonly pedunculated and have a poor blood supply. Histologically, they consist of a delicate fibrous stroma containing a few blood-vessels and covered with layers of thick pavement epithelium. Papilloma are also found most commonly in the posterior urethra, and resemble granulomata in appearance.

Polypi occur at almost any part of the urethra. They are pale and translucent and usually pedunculated.

These growths are occasionally responsible for a chronic gleet, and it is obvious that urethroscopic examination is the only means of diagnosing their presence.

Treatment consists in removing the growth with a curette or electric-cautery, and it is advisable to destroy the base to prevent recurrence.

Luy's urethroscope makes no provision for air-distension, but experience has proved that it is particularly useful in the treatment of cases by this means.

The advantage of Luy's instrument lies in the fact that after a polypus has been manœuvred into a suitable position for curetting, the magnifying eye-piece can be easily turned to the side or removed to allow of the introduction of the curette without in any way disturbing the position of the polypus in the field. In aero-urethroscopes the eye-piece is firmly attached to the tube and its removal is such a clumsy procedure that almost invariably the field is moved and the polypus slips out of view.

Case XVII.—History—Infection in 1916. Troubled with gleet ever since. Slight difficulty in passing water.

14.6.21. Urines—(1) Slight haze; (2) clear. Scoped—"Large sessile polypus seen in scrotal urethra. Smaller pedunculated

polypus situated 1½ inches from meatus. In other respects urethra normal." After removal of these growths the patient had no longer any difficulty in passing water, and the gleet disappeared.

Discharged cured.

Case XVIII.—26.2.21. History—Infection 1914. Treated with irrigations and vaccines. Complaint—Chronic gleet. Urines—(1) Hazy, with threads; (2) slight haze. Scoped—"Follicles rather prominent, but none discharging. Pedunculated polypus seen in deeper part of urethra. Another smaller one in mid-penile region. Urethra dilates well."

The polypi were removed with the curette, and the base of each destroyed. The follicles were next treated; and one month from the time of reporting patient was cured.

Case XIX.—History—Gonorrhœa 1917. Treated with irrigations, also silver nitrate in doubtful strength, injected with a syringe. Complaint—Occasional slight bleeding on urination for past sixteen months. Patient was cystoscoped and nothing found.

14.7.21. Scoped—"On overcoming compressor urethræ muscle with inflation, commencement of membranous urethra seen to be granular, and looks as if it would bleed easily. No lesion of anterior urethra."

15.7.21. Posterior urethroscope (Wossidlo) used—"Mucosa of posterior urethra seen to be granular and ulcerated." Oscol Argentum was instilled into posterior urethra on five successive days and held in for a short time.

3.8.21. Béniqué 24 passed. No bleeding. Silver solution injected on two more occasions.

28.8.21. Posterior scope—"Mucosa of posterior urethra now healthy." No trace of ulcerations. Urines—(1) Clear; (2) clear.

Case XX.—N. L. P. Lumb, in his book on the urethroscope, describes a remarkable case which came under his care. The case was one of relapse, which five months of treatment had failed to clear up. Six groups of papillomata were found at different spots, four in the penile urethra, one in the membranous portion, and one at the side of the verumontanum. The latter two were removed by means of Buerger's forceps through the cysto-urethroscope, and the others with the curette. The bases were cauterised, and the after-history was uneventful.

(b) *Cysts* are formed from Littré's glands by the mouths becoming blocked and the walls distended with secretion. They are as a rule easily ruptured by Kollmann's dilator, failing which they should be incised.

Case XXI.—History—First attack. Duration, eight weeks.
26.5.21. Scoped—"Small cyst, thin-walled; size of split-pea; seen at entrance to bulbous urethra; otherwise urethra normal."
27.5.21. The cyst was incised and then touched with iodine.
After-history uneventful.

(c) *Anatomical Defects.* — Valves — The exact nature of valves is uncertain. According to one theory they are derived from the circular muscular bundles of the urethra as a result of over-development; according to another they are merely reduplications of the mucosa. It has been suggested that in some cases valves are due to folds in the mucosa produced by abnormally large lacunæ of Morgagni.

They vary in size and are usually found in the roof of the anterior urethra. The diagnosis of their presence depends on urethroscopy. In appearance they are U or V shaped like an incomplete diaphragm.

When treatment is necessary it consists in dividing the valve with a knife or cautery, and the flaps formed then rapidly shrivel.

Case XXII.—History—Third attack. Condition cleared up under treatment.
12.7.21. Scoped — "Small irregular diaphragm seen at entrance to bulbous urethra." Edges and base clean. Urethra healthy. Urines—(1) Clear; (2) clear. No clinical signs of disease. Case discharged.

(d) *Diverticula.*—These are either congenital or acquired, and like valves occur very rarely.

The congenital type usually gives a history of urinary disturbance such as dribbling, tumour formation, or even obstruction, beginning in infancy or childhood.

Acquired diverticula are formed from various causes. In a case of stricture the urethra may dilate on the proximal side, and from the resulting stagnation of urine, the wall may weaken and lead to the formation of a diverticulum. Abscesses, cysts, fistulas, or the careless manipulation of an instrument are also liable to bring about the same result. Diverticula are sometimes the cause of a persistent urethral discharge, though not necessarily gonococcal in nature.

It sometimes happens, as in the two cases cited below, that there is nothing to indicate the presence of a diverticulum, the diagnosis being made during a casual urethroscope examination.

Case XXIII.—History—First attack. Incubation, seven days.
18.8.20. Case treated with irrigations, vaccines, and prostatic massage.
22.10.20. No evidence of discharge; prostate negative. Urines—(1) Clear; (2) clear. Smears satisfactory.
9.11.20. Scoped—"Diverticulum seen in floor of bulbous urethra. Mucosa healthy." In this case the diverticulum was probably congenital. No history of abscesses, stricture, or cyst. Patient stated he had never had instruments passed at any time. There seemed to be no indication for treatment.
Discharged cured.

Case XXIV.—3.1.21.—History—First attack. Incubation, five days. Patient was under treatment for four months. Owing to sexual excesses the discharge was definitely purulent practically all that time.
28.4.21. When the urines had cleared up urethroscopy was performed. An acute infiltration was found in lower part of penile urethra, and a diverticulum seen just immediately beyond. The mucosa was much inflamed, also the body of the penis at that part. In this case the diverticulum was probably acquired as a result of the prolonged suppuration. Unfortunately it was not possible to follow up this case as patient left the country.

Operative Urethroscopy—(a) *Passage of Filiform Bougies.*—Every now and then, in the experience of most surgeons, a case of stricture comes for treatment in which all attempts to pass small-size bougies by the ordinary methods meet with failure.

The difficulties in such a case are several.

(1) There is the primary difficulty in locating the opening of the stricture.

(2) Gum-elastic bougies of small size soon double up when any force is used.

(3) Whalebone bougies are firmer than gum-elastic but are very liable to cause hæmorrhage.

(4) Vain efforts on the part of the operator to locate the opening may cause damage to the urethra immediately above the stricture.

Operative urethroscopy can generally be relied upon to solve these difficulties. Cambell's urethroscope will be found useful for this purpose, as it has supplied with it a special eye-piece, containing a small aperture through which a filiform bougie can be passed. This arrangement is not absolutely air-tight, but if the size of the aperture and the bougie approximate,

a fair degree of air-distension can be maintained. By this means it is possible, firstly, to locate the opening of the stricture, and secondly, to distend the opening and thus facilitate the passage of a filiform. By thus dilating a stricture and passing a filiform under control of the eye, it is frequently possible to succeed in cases where all other methods have failed. It is advisable to employ a local anæsthetic to relieve any spasm, and adrenalin solution to limit hæmorrhage. The following cases were treated in this way:—

Case XXV.—History—Infection 1912. Treated with irrigations of permanganate. Complaint—Gleet. Examined recently in Dublin with urethroscope and operation advised.

3.11.20. Urines—(1) Hazy, with threads; (2) hazy. Scoped—"Very tight stricture seen 3½ inches from meatus. Opening very small; dilates poorly." Novocain and adrenalin were first injected into the urethra and then a gum-elastic bougie was passed down the urethroscope and through the stricture. The bougie was left in for twenty-four hours. Subsequently progressively larger sizes of bougies were passed without the aid of the urethroscope.

6.2.21. Béniqué 22 passed.

6.3.21. Scoped—"Stricture well seen. Greatly improved." Patient ceased attending.

Case XXVI.—16.7.20. History—Infection 1916. Treated himself with Sandalwood Oil Capsules. Complaint—Pain on micturition.

30.7.20. Scoped—"Marked fibrous stricture seen in deeper part of urethra at entrance to bulb. Mucosa anterior to stricture is healthy." In this case also passage of a bougie was only possible through the urethroscope. The treatment in this case was highly successful. Béniqué bougies up to 24 were passed easily six months later, and the stricture was then over-dilated at several sittings by Kollmann's (curved) dilator.

15.1.21. Kollmann (curved) 39.

29.1.21. Béniqué 26 passed.

Discharged.

(b) *Electro-Cautery and Curette.*—In the removal of polypi and other growths these instruments are of great value. In the case of a pedunculated growth it is usually a simple matter to remove it with the curette through the urethroscope. For reasons already stated Luy's instrument will be found very

convenient. The growth is localised, manœuvred into a suitable position, and then removed gently so as to avoid damaging healthy tissue.

Local anæsthesia is not necessary, but adrenalin in solution should be at hand as, if the growth is not completely removed at the first attempt, bleeding is almost certain to be troublesome and obscure the field. If swabs soaked in adrenalin be lightly applied to the bleeding point hæmorrhage soon ceases and the operation can be completed. It is essential to cauterise the base after removal of the growth, otherwise it is very liable to recur. This can either be done with pure silver stick fused on to a probe, or with the electro-cautery at dull red heat.

For growths that are sessile in nature the electro-cautery is very satisfactory. Naturally great care and a steady hand are essentials, otherwise healthy tissue is almost certain to suffer. One advantage of the cautery is that hæmorrhage is rarely troublesome.

In Case XVII. already described, the pedunculated polypus was removed with the curette and in the other the electro-cautery was used.

(c) *Operative Treatment of Peri-Urethral Abscess.* — Occasionally it may be found necessary to relieve a peri-urethral abscess by incision. This is done through the urethroscope by means of a special knife designed for the purpose. It is rarely necessary to do this, however, as non-operative measures are generally successful.

(d) *Urethroscopic Internal Urethrotomy.*—The operation is very limited in this application, being only possible in cases of thin diaphragm-like stricture, situated more or less transversely across the urethra. Technic of Operation—The patient is prepared in the usual manner and the largest urethroscopic tube possible introduced. The size is important, as it is essential that the tube should not pass beyond the stricture but be pressed against it, so that the fibrous band will be stretched taut across the opening. The stricture is then divided from base to free edge. Sounds should be passed to open the incision to the full diameter of the urethra. There is always the possibility of relapse in cases treated in this manner, and the passage of bougies for a time at intervals is necessary to prevent this.

(e) *Application of Caustics to Infected Follicles.*—It is the practice of many urologists to treat infected follicles by de-

stroying them with pure silver stick fused on to a probe. This operation is carried out through the urethroscope, and in theory the probe is supposed to be passed throughout the entire length of each follicle. In actual practice it is very doubtful if the probe ever succeeds in doing any such thing. The mouth of a follicle, even in disease, is very small. In addition the structure of the larger glands is very intricate. They are described in Cunningham's *Text-book of Anatomy* as being "deeply placed beneath the mucous coat, and communicating with the urethra by long slender obliquely-placed branched ducts." Some of the glands also open into the lacunæ,

It is obvious therefore that no probe, however slender, can possibly convey a caustic throughout gland ducts so minute and tortuous. Even admitting the possibility of success in the case of the smaller glands with short ducts, all that happens in the great majority of cases so treated is that only the mouths of the follicles are destroyed. When the probe is applied to the opening of a follicle, and pressure applied to force it through the duct, the urethra, being a flexible tube, gives way before it, so that the probe merely cauterises the gland entrance. If only the mouth of an infected gland is destroyed then infective material capable of liberating toxins remains pent-up in the duct. The treatment of folliculitis therefore by cauterisation is unsound, as it possesses no certainty of success and has many disadvantages. The best method of treatment is to aim at emptying the glands and thus free them of infection.

Conclusion.—In the preceding pages it has been attempted to demonstrate briefly the importance of urethroscopic examination in the diagnosis and treatment of gonorrhœa. The uses of the instrument in these connections may be conveniently summarised in the following way:—

(1) The urethroscope enables an accurate diagnosis to be made of many lesions, the presence of which in the vast majority of cases would otherwise escape undetected. Folliculitis is a case in point. Apart from gross manifestations there is only one sure method of detecting diseased follicles, and that is by looking at them through the urethroscope.

(2) In the diagnosis of the various stages of urethral infiltration the instrument plays an all-important part. In the early stages it affords the only possible means of diagnosis, while in the later stages when contracture has taken place it is the most accurate and instructive.

(3) For the diagnosis of stricture urethroscopic examination is essential. The passage of a bougie merely gives information of the presence of a narrowing in the canal; it fails to differentiate between stricture and spasm. By urethroscopy, on the other hand, it is possible to distinguish between these two conditions, and in a case of stricture gain accurate information regarding its exact site, the degree of narrowing present, the position and condition of the opening, and an idea of the size of instrument it will be possible to pass.

(4) The diagnosis of the rarer conditions occasionally met with, such as granulations, polypi, and congenital abnormalities, depends entirely on the use of this instrument.

(5) In conditions requiring instrumental treatment the urethroscope enables the surgeon to follow very closely the progress of each case, and exercise control over treatment in a manner which he could not otherwise do.

(6) In lesions of the urethra necessitating operative interference, the urethroscope is absolutely essential, as it is only through it that operative measures can be carried out.

(7) The frequency with which the follicles and sub-mucous tissues become infected in gonorrhœa renders it imperative to make a urethroscopic examination in every case.

(8) It is impossible to form an opinion of any value as regards prognosis or cure unless such an examination has been made. The important bearing, therefore, which the instrument exercises with regard to the question of marriage is obvious.

(9) The part played by the urethroscope, therefore, in the diagnosis and treatment of gonorrhœa is an all-important one. Undoubtedly many cases can be cured without its aid, but these successes are attained more by good fortune than by design. Any scheme of treatment which omits a careful urethroscopic examination in every case, leaves too much to chance, and renders a sound prognosis impossible. On the contrary the advent of the modern urethroscope has made it possible to give a prognosis so certain as to amount practically to a guarantee of cure.

In conclusion I should like to express my indebtedness to Mr David Lees, D.S.O., F.R.C.S.E., for the interest he has taken in this paper, and for permission to publish notes of cases under his charge.

REFERENCES.—L. W. Harrison, *Manual of Venereal Diseases*, 1919. N. L. P. Lumb, *The Urethroscope*, 1919. Kidd, *Common Diseases of the*

Male Urethra, 1919. Pedersen, *Text-book of Urology*, 1919. Cunningham, *Text-book of Anatomy*, 1920. Delafield and Prudden, *Text-book of Pathology*, 1920. Beattie and Dickson, *Text-book of Pathology*, 1921. Harrison, "Discussion on Modern Treatment of Gonorrhœa," *Trans. Med. Soc.*, London, 1919. Stern, "Treatment of Urethral Stricture," *New York Med. Journ.*, 1920. Powell, "Treatment of Chronic Urethritis, with Description of a New Instrument for Cauterising the Lacunæ," *Brit. Med. Journ.*, 1919, vol. xi., pp. 161-164. Hughes, "Urethroscopy," *Journ. Roy. Naval M. S.*, 1919. Englander, "Diverticulum of the Urethra," *Journ. Amer. Med. Assoc.*, 1917. Lumb, "A Urethroscopic Tube," *Brit. Med. Journ.*, 1920, vol. i., p. 771. Willis, "Standard of Cure in Gonorrhœa," *Austral. Med. Journ.*, April 1920. Smith, "Latest Remedial Measures in Gonorrhœa," *Internat. Journ. Surg.*, New York, 1920.

CLINICAL RECORDS

A CASE OF CONGENITAL NARROWING OF THE ŒSOPHAGUS.

By K. PATERSON BROWN, M.B., F.R.C.S.E.

(*From Mr Alexander Miles' Clinic*)

In a recent communication[1] Mr D. M. Greig has drawn attention to the clinical importance of recognising congenital narrowing of the œsophagus as a cause of dysphagia. As the clinical records of the condition are somewhat rare, the notes of a case which has lately been under observation in the Royal Infirmary may be added to supplement those observed by Mr Greig.

Case.—James C., a bright, intelligent lad of 15, came to the Infirmary on the recommendation of Dr Robertson of Chirnside, on account of recurrent "vomiting" which had troubled him at varying intervals "all his life." His mother, who accompanied him, stated that he was a healthy baby; he was breast-fed for ten months, and during this time only occasionally brought up milk and mucus-like material, which was attributed to teething and did not interfere with his nutrition. He has two brothers and one sister, all healthy, none of whom have suffered from difficulty in swallowing.

After being weaned, his principal diet was Allenbury's food and rice biscuits, with hot milk, and so long as this was continued he was not troubled much with "vomiting." About the age of $2\frac{1}{2}$ he was given more solid food, and coincidently he began to suffer. From his mother's description it would appear that the child had some difficulty in swallowing certain articles of diet, and that part of what he had taken regurgitated soon after. It was not true vomiting. This continued off and on till he was 5, when he was taken to the Sick Children's Hospital, where he was kept under observation for some months. The condition, however, did not improve and he continued to regurgitate his food intermittently till he reached the age of 7.

He then went to school, and from this time till he was 14 he had very little trouble, either in swallowing or from regurgitation. He developed normally and was able to hold his own with boys of his age.

On leaving school he was put to farm work, and soon after the symptoms reappeared. He had gradually increasing difficulty in swallowing solids; sometimes he seemed to "choke" and the food

returned; at other times he had a heavy feeling in the epigastrium and behind the sternum, which gradually wore off, without any regurgitation taking place. The symptoms were definitely intermittent: sometimes the regurgitation occurred at every meal for two or three days on end; or it might be absent for one or two weeks. From a record of his diet carefully kept by his mother there does not appear to have been any constant relationship between the nature and consistence of the meal and the occurrence of regurgitation. For some weeks before his admission to the Infirmary on 15th February 1922, he had been worse than ever before. Although he was careful to masticate his food he had considerable difficulty in swallowing, the food seemed to stick behind the ziphi-sternum and almost immediately both fluids and solids were regurgitated. He became weaker and lost weight and eventually had to give up work. There was never any pain or nausea, and the food came up unaltered.

Under hospital regime: rest, fluid and semi-solid food, he improved, and began to regain strength, but once every few days there was some regurgitation. During one of the quiescent periods a gum elastic bougie was passed and was arrested 9½ ins. from the teeth. A radiogram taken at this time, after a semi-solid opaque meal, showed a definite narrowing of the œsophagus, extending for a distance of about 2 ins. above the level of the diaphragm, the lumen being slightly less than an ordinary lead pencil. Above this constricted area, the œsophagus, filled with bismuth, is apparently dilated (Fig. 1). It should be noted, however, that in the presence of an obstruction the semi-solid bismuth, unable to pass on normally, acts in the same way as a solid bolus. The dilatation, therefore, may be no more marked than would be seen when a solid bolus of similar size passed down a normal œsophagus.

Apart from being kept on a moderately soft diet he had no treatment while in hospital, and after a month, being free of symptoms, he was allowed to go home.

Comments.—The history of this case appears to leave little doubt that the condition is one of congenital narrowing of the œsophagus. The onset of symptoms related to the commencement of a more solid dietary is an important diagnostic point, which has been noted by most observers. Greig[1] states "The great majority of congenital narrowings cause no symptoms as long as the diet is fluid, and especially if the infant, breast-fed, has its natural and most suitable food." It is doubtful if any importance attaches to the somewhat indefinite history of vomiting during the first few months in this case. Had the constriction been such as to cause obstruction to fluids at this

FIG. 1.

stage, it seems likely that the symptoms in later years would have been more severe and persistent, and that the patient's development would have suffered. Turner[2] quotes a case in which no symptoms of œsophageal obstruction appeared until the child was weaned at the thirteenth month, yet immediately thereafter vomiting commenced and death occurred at the eighteenth month. An obstruction at the lower end of the œsophagus was found post-mortem. The history of our patient suggests that although the condition had recently become more severe and caused actual loss of weight, this may have been related to the increased strain to which the boy was subjected as a farm worker, necessitating a fuller diet than formerly. There is no evidence that the condition tends to get progressively worse. Greig[1] gives a case of a woman who died at the age of 82, and Wilks[3] records the case of a man who died at the age of 74, having suffered from difficulty in swallowing since childhood. In neither case was the œsophageal obstruction the immediate cause of death. The intermittent difficulty in swallowing is quite consistent with congenital narrowing, and is especially noticeable in the minor degrees of this condition. The same intermittency of symptoms is noted in both the malignant and the traumatic forms of stenosis.

The only line of treatment is one which the patient very early adopts for himself, namely, care in the choice of diet.

REFERENCES:—[1] Greig, D. M., "Cardiospasm, Congenital Narrowing of the Œsophagus and Œsophagectasia," *Edin. Med. Journ.*, July 1921. [2] Turner, F. C., "Congenital Stenosis of lower end of Œsophagus," *Trans. of Path. Soc.*, 1885, vol. xxxvi., p. 185. [3] Wilks' "Dilatation of the Œsophagus," *ibid.*, 1866, vol. xvii., p. 138.

A CASE OF MYOSITIS OSSIFICANS PROGRESSIVA IN A CHILD.

By JOHN A. HENDERSON, M.B., Ch.B. (Edin.), Alvaston, Derby.

THE following are notes and photograph of this very rare disease. Many text-books merely mention the condition, others do not refer to it at all. Thomson[1] describes it fully, and Fordyce[2] also describes it. The history of this case dates right back to the first weeks of infancy, and from that time to

FIG. 1.

the present the child has undergone a good deal in the way of treatment, but she is now not any better but rather worse.

CASE.—A female child, æt. $3\frac{1}{2}$, the youngest of three, the two older children being perfectly healthy boys. The parents are healthy with nothing particular to note in regard to them. No history of any similar condition on either the father's or mother's side. The child was apparently normal at birth, except that the mother noticed that

both great toes were very small. Dentition and walking not delayed. No mental defect. She has a tendency to catarrh of the respiratory tract. Previous illnesses—measles and chickenpox.

History.—Confinement normal. When the child was two weeks old the mother, an intelligent woman, noticed a swelling on the left side of the neck, which she thought was an enlarged gland. It did not seem tender to touch, but she noticed that, when the child's head was allowed to fall backwards and to the right, that is, when the muscle was put on the stretch, the child always cried. She also noticed that from this time onward the child began to develop a wry-neck, a condition not present at birth. When six weeks old, she was taken to an institution, where massage was recommended. This was carried out at home, but the child's head became more drawn downwards and rotated to the right. At six months she had an attack of "congestion of the lungs," but no swellings were noticed at that time. The massage was continued. Some time afterwards the mother noticed a firm swelling, about the size of a hen's egg, on the back of the child's head, and five smaller swellings distributed over the parietal and occipital regions. These did not cause the child any inconvenience, and were then regarded as an indication that the child had rickets.

Meanwhile the torticollis was becoming worse, and in September 1919 an operation was performed for the rectification of the condition. A month afterwards it was more marked than ever. It was after this that I first saw the child during an attack of measles. No special attention was paid to the neck at that time, as I took it to be an ordinary congenital torticollis. In May 1921 a suppurating gland on the left side of the neck was opened, and it healed without difficulty. In October 1921 she was again admitted to an institution, and a second operation was performed, at which, the mother informed me, "bone was found in the muscle." The sister-in-charge informed the mother that "the child's spine was weak," and a three months' stay in hospital was advised. She was discharged in January 1922, and was brought to me shortly afterwards with a hard reddish swelling over the upper three dorsal vertebræ. The child looked a typical text-book picture of Pott's disease. The swelling was tender to touch, she held her back rigid, supported herself with her hands, and picked articles off the floor by flexing the knees. By that time I had read Dr Thomson's article, but the appearance was so characteristic of spinal caries that one ruled out the possibility of this being one of the swellings found in myositis ossificans. However, what did strike one was the fact that the child did not look ill, and if left alone would stamp about on the floor. Unfortunately, a photograph was not taken at this time, and I advised the parents to take her back to hospital to have the "spinal caries" treated. Evidently the same diagnosis was arrived at there,

as two months later the child came home in a poroplastic jacket, with a specially softened area to accommodate the "kyphosis," but which deformity, to my amazement, had disappeared entirely, with the exception of a very small nodule. She now had a large swelling on the occiput, and three smaller ones round about, the presence of which she explained to her mother by saying that "nurse let her fall." She had, in addition, fullness and swelling of the muscles in the right supra-spinous fossa extending to the middle line posteriorly. From the inferior angle of the right scapula another diffuse swelling extended forwards to about the seventh rib in the mid-axillary line, gradually shading off over the right chest wall. These areas were obviously tender, and the child could not be persuaded to raise the arm above the level of the shoulder. They were of a somewhat dusky colour. There was another small firm swelling, the size of a walnut, in the lower lumbar region. The spinal jacket was disposed of, and the mother instructed to return if she noticed any more swellings.

Very obligingly the child fell backwards on 8th April, striking her back and the nape of her neck. This caused a condition recognisable in a photograph: a globular swelling about the size of a tangerine orange at the back of the neck, and a more extensive swelling on the back—firm, tender, but not discoloured. The movement of the right arm in an upward direction was very much restricted, and the child objected very much to its being moved. Further, in the anterior right axillary fold in the pectoralis major there could be felt two bony masses (which have persisted), about the size of two small marbles. In the submental region the anterior bellies of the digastric muscles are hard, and feel like two pieces of pencil. The child's speech is now somewhat thick; the masseters are not affected. She presents another feature of this strange disease, microdactyly of the great toes (Fig. 1), but her thumbs are normal. The swellings in this case showed no symmetry whatever, and they were all the result of a definite injury to the part—the diffuse swelling being due probably to friction from the poroplastic jacket. The muscles of the lower extremity are, as yet, unaffected, but the child has developed a peculiar high stepping gait, apparently from the fixed position of the head, which prevents her from seeing exactly where she is placing her feet. The muscle originally affected—the left sterno-mastoid—now shows considerable bony formation, its anterior border being as rigid as the clavicle to which it is attached.

The chief points may be summarised thus:—

(1) The disease is characterised by periods of quiescence, alternating with "acute phases," during which the slightest trauma produces the swellings described. The quiescent stage

may last a year or more as in this case, and the acute phase has lasted over three months and is still present.

(2) The disease is present at birth, but does not manifest itself until the acute phase is present.

(3) The swellings themselves are apparently of the nature of an acute myositis with subsequent increase of the connective tissue, and fibrous transformation of the muscle.[3] In some of the muscles bone is laid down, and judging from the history of this case the formation of bone progresses, irrespective of whether the acute phase is present or not, once the process has been started. Many of the swellings disappear entirely without any obvious change in the muscles. Some in this case were apparently situated in the muscle aponeurosis, and not in the muscle proper, *e.g.*, in the aponeurosis of the occipito-frontalis.

(4) Characteristic deformity of great toes and sometimes of thumbs is present from birth, and its presence should lead one to suspect the condition.

(5) The muscles chiefly affected are those of the "scalp, neck, trunk, limbs, and masseters, leaving unaffected hands, feet, muscles of expression, external eye muscles, muscles of pelvis and genital organs, the sphincters, and all unstriped muscle." The cause is unknown, and treatment of no avail.[4] Active interference, such as operation or massage, only makes matters worse.

(6) No rise of temperature has been noted in the case.

REFERENCES.—[1], [4] Thomson, Dr John, *Clinical Study and Treatment of Sick Children.* [2] Fordyce, Dingwall, *Diseases of Children.* [3] Shennan, *Post-mortems and Morbid Anatomy.*

NEW BOOKS

Pathology of the Nervous System. By E. Farquhar Buzzard, M.A., M.D., F.R.C.P. and J. Godwin Greenfield, B.Sc., M.D., F.R.C.P. Pp. xv + 334, with 103 illustrations. London: Constable & Co. Ltd. Price 30s.

It has long been felt that there is a vacant place for a text-book on the pathology of the central nervous system, and the authors of this volume are meeting a real and widespread need. They recognise that light thrown upon the problem of neuro-pathology may help in the solution of many problems in general pathology. The scope of the book is a wide one, for it includes the anatomical changes which underlie disease, questions of pathogenesis, and an endeavour to correlate the pathological findings with the clinical symptoms. The extensive clinical and pathological experience of the writers and their wide reading are apparent throughout, more especially in the sections devoted to the cerebro-spinal fluid and the paths of infection of the central nervous system, and also in the summaries of present-day views on many nervous problems.

The most conspicuous quality of the book is its lucidity: the descriptions are brief, clear, and easy to follow. While the work will prove of great value to medical students desiring a short and concise summary of its subject, the present writer rises from a study of it—the only text-book on the pathology of nervous diseases in the English language—with a sense of disappointment. The descriptions of the pathology of many of the diseases are very superficial and could be equally well obtained in any good text-book of nervous diseases, while many of the more interesting problems for which a book devoted purely to nervous pathology is consulted, are not even referred to. The chapter on "Diseases of Obscure Origin" and the illustrations accompanying the section on tabes dorsalis are instances of this failure to give any lead in points at issue.

Injuries of the Peripheral Nerves. By Henry S. Souttar, C.B.E., and Edward W. Twining. Pp. 148. Bristol: John Wright & Sons, Ltd. Price 18s. 6d.

The authors of this interesting and instructive monograph have had an extensive experience in the examination and correction of peripheral nerve injuries, and in this contribution they been successful in applying the knowledge they have gained to the demands of civil life.

Exception must, however, be taken to the statement on page 3—"It is natural in the exigencies of work behind the lines that nerve injuries should usually be overlooked." This statement is not correct,

and the reviewer appreciates from actual experience how exceptional was the non-recognition of nerve injuries by officers of field ambulances and regimental medical officers.

The book is pleasantly written; there is no unnecessary detail, and it gives the impression that the authors have been actually brought into contact with the very real difficulties which surround this branch of surgery. The sequence of the matter is well chosen. The chapters dealing with "Changes in the Nerves" and "Changes in the Tissues" are disappointing, but the portions of the book which deal with the practical side of the questions at issue are excellent. A great deal of improvement might be looked for in the matter of illustrations. But, in spite of these criticisms, the book is a practical treatise written by practical men, and is a valuable contribution to one of the most difficult branches of surgery.

Epidemic Respiratory Disease. By Eugene L. Opie, M.D., Francis G. Blake, M.D., James C. Small, M.D., Thomas M. Rivers, M.D. Pp. 402. Illustrated. London: Henry Kimpton. 1921. Price 36s. net.

The epidemic of influenza which spread across the world during 1918-19 furnished abundant opportunity for the study of pneumonia in its epidemic form. Not only was influenza complicated during these epidemics with the occurrence of broncho-pneumonia, but also the incidence of lobar pneumonia reached almost epidemic proportion. In the United States of America during the autumn of 1917 there was a very high incidence of pneumonia in their mobilisation camps, in fact, lobar pneumonia, broncho-pneumonia, and measles account for 61.7 per cent. of all deaths. During the spring of 1918 the epidemic of influenza made its appearance. Corresponding with this epidemic there was a great increase of pneumonia, the incidence of the two diseases reaching a maximum almost simultaneously. Such havoc was wrought amongst the newly mobilised troops by these diseases that the United States Government appointed special Commissions to investigate these diseases at their various concentration camps. The present volume is an account of the investigations undertaken by one of these Commissions at Funston.

A clear distinction is drawn between those cases due to the pneumococcus and those due to the streptococcus hæmolyticus; not infrequently these two organisms occurred together. The variegated clinical picture presented would indicate that there was a great variety of susceptibility, and this was further emphasised by the fact that after each influx of fresh troops to the camp, aggravation of the epidemic developed. A full discussion of the differences and

similarities of the pneumonias following measles and influenza is given.

One of the most important sections is that given up to an investigation of the treatment of pneumonia as it occurs in such epidemics. It is clearly pointed out by the authors that such a spread of pneumonia is preventable in large measure by the early and rigid segregation of cases of influenza. They also lay stress on the importance of detecting carriers of virulent pneumococcus and streptococcus hæmolyticus, in order that such people may be prevented from coming in contact with those who are already ill. The only cause of death in influenza and measles being lobar pneumonia or broncho-pneumonia, if this can be prevented, the diseases otherwise run a mild uneventful course. Experimental inoculation of monkeys with bacillus influenzæ and micro-organisms isolated from the pneumonias of influenza, seems to prove that the bacillus influenzæ in itself is of rather low pathogenicity, but when associated with either the pneumococcus or streptococcus hæmolyticus it acquires enhanced virulence or for the individual enhanced susceptibility.

Le Problème du Cancer. Par WILLIAM SEAMAN BAINBRIDGE, A.M., Sc.D., M.D., C.M., LL.D. Pp. xxiv + 484, with frontispiece and 37 plates. Louvain: A. Uystpruyst. Paris: O. Doin. 1922.

Cancer and its Non-surgical Treatment. By L. DUNCAN BULKLEY, A.M., M.D. Pp. vii + 457. New York: William Wood & Company. 1921. Price $6.

These two books between them contain a comprehensive review of the problem of malignant tumours in its various aspects. The former (translated from the English edition) especially is to be recommended to those who desire a complete epitome of the subject.

Dr Bulkley's book aims at establishing on "firm scientific grounds the proofs of the constitutional nature of cancer," and at giving "a satisfactory presentation of the disease Carcinosis, as its results or products affect various portions of the human economy." The book, while possessing considerable value to the special reader, is robbed to some extent of its general appeal by the fact that its viewpoint is local and circumscribed. In an interesting chapter on the bio-therapy of cancer, reference is made to the treatment of inoperable sarcoma by the mixed toxins of erysipelas and bacillus prodigiosus introduced by Dr Wm. B. Coley in 1893, and it is stated that out of 250 personal cases Coley has 31 well for a period of more than three years.

New Books

The Endocrines. By S. W. Bandler, A.B., M.D., F.A.C.S. Pp. 486. Philadelphia and London: W. B. Saunders Company. Price 35s. net.

The author of this work is Professor of Gynecology in the New York Post-Graduate School and Hospital. His enthusiasm regarding the subject of the endocrines has caused him to plunge so wholeheartedly into the practice of opo-therapy and to find such benefits derived by patients on whom he would formerly have operated that he might be described as a surgeon-gynecologist become physician and psychotherapist. The scope of the book is such as to incite the interest of the alienist, neurologist, gynecologist, obstetrician, dermatologist, physician, and many others. From all, the book would receive a fair amount of adverse criticism, especially in those sections devoted to gland therapy and the hypotheses on which he bases it. In these sections the material appeals chiefly to the gynecologist, who may find it worth his while to test the methods of the author applied as they are to an extremely varied assortment of gynecological disorders.

Interspersed with a mass of material from the works of Cushing, Biedl, Falta, Cannon and others, there is much that at present can be only regarded as visionary. The book is one which can be recommended for consideration by the critical reader.

Management of the Sick Infant. By Langley Porter, B.S., M.D., M.R.C.S. (Eng.), L.R.C.P. (Lond.), and William E. Carter, M.D., University of California. Pp. 654 with 54 illustrations. London: Henry Kimpton. 1922. Price 42s. net.

This large volume deals principally with the treatment of babies and young children. The first section takes up a series of common symptoms, such as vomiting, diarrhœa, constipation, hæmorrhage, cough, etc., and under each heading gives a list of the diseased conditions causing the symptom, with the appropriate treatment for each. A second section gives the usual pathological classification of diseases according to systems, again giving for each disease a concise account of its treatment. The third and final section is devoted to the methods of treatment, the withdrawal of blood, the injections of fluids and medicinal substances by various routes, the special diagnostic procedures, the irrigation of cavities and passages, the administrations of baths, packs, and poultices, and so on. In this part of the book, directions are tabulated in a clear way, and these directions are assisted by numerous photographs of the different procedures. The book is inadequate as a clinical text-book of the diseases of infants, but is useful as giving a clear account of the special methods of treatment.

New Books

Rickets. By J. Lawson Dick, M.D. (Edin.), F.R.C.S. (Eng.). Pp. ix. + 488, with 7 plates and other illustrations. London: William Heinemann Ltd. 1922. Price 25s. net.

In his book Dr Dick deals with rickets from its historical and social sides rather than from its clinical aspects. The distribution of the disease throughout the world is carefully described; and its special prevalence in the large cities of Europe and America, and its rarity in Africa, Asia, and Australasia, are accounted for by the confined and sunless surroundings of young infants in the slum dwellings of large industrial cities. The history of the disease is also traced, and reasons are given for the belief that rickets is a comparatively young disease, beginning in England and Europe between three and four hundred years ago. But though the author is more concerned with etiology, and is a strong advocate of the view that rickets is a disease of bad hygiene rather than of imperfect diet, the clinical aspects of the disease are also dealt with. In particular, an interesting account is given of the changes of the teeth, and also of the frequent association of lamellar cataract with rickets; these are stigmata by which the previous existence of rickets in infancy can be established.

Blood Transfusion. By Geoffrey Keynes. Pp. 158, with 13 illustrations. London: Henry Frowde and Hodder & Stoughton. 1922. Price 8s. 6d. net.

The author has given a full and satisfactory account of transfusion, and in an interesting introductory chapter on the history of the operation, due credit is given to the work of American surgeons in recent years. In considering the indications for transfusion, chief stress is laid upon the commoner conditions likely to be benefited, but useful references are given to the results obtained in some of the rarer conditions for which it has been employed. The value of transfusion, not yet generally recognised, in hæmophilia and in hæmorrhagic disease of the new-born, is rightly emphasised. A clear account is given of the physiology and pathology of blood groups and of the dangers of incompatibility. In reviewing the different methods available for transfusion, preference is rightly expressed for the citrate method which, for simplicity and reliability, is more adapted for general use than many of the methods of whole blood transfusion. A useful bibliography is added of the more important contributions to recent literature.

NEW EDITIONS

Cancer of the Breast and its Treatment. By W. Sampson Handley. Second Edition. Pp. xvi + 411, with 82 illustrations. London: John Murray. 1922. Price 30s. net.

This re-statement of the permeation theory of the dissemination of cancer associated with the name of Mr Handley goes to support the soundness of his pathological doctrine, which, since the issue of the first edition of this work in 1906, has had considerable influence in determining the operative measures adopted to eradicate cancerous growths, particularly in the breast. Since Mr Handley's views were generally accepted, surgeons have widely extended the range of their excisions, and the routine operation for the removal of a cancerous breast is now one of considerable extent and severity. In the sixteen years that have elapsed there has been time to test the efficacy of these procedures, and we naturally turned with interest to the section on "The comparative results of the different methods of operation," in the hope of finding that these extensive operations were justified by an equivalent immunity from recurrence, but this section stands *verbatim* as in the 1906 edition. "For the benefit of those who attach great importance to statistics" (among whom on such a question we number ourselves) a short note on "Personal Results" is added. It includes 52 cases, of which about 48 per cent. have "passed the three-year limit." We confess we are disappointed. This, after all, is the vital test of the practical value of the author's most exhaustive scientific researches, and by it they must stand or fall as a contribution to surgical therapeutics. The omission of this evidence from such a work as that now before us is a serious one. It is suggestive that a new chapter on "Recurrence and its operative treatment" has been added. The new chapters on "Radiological treatment" and on "Paget's disease of the nipple" are excellent. The publisher's share in the production of the volume leaves nothing to be desired.

The Essentials of Laboratory Diagnosis. By F. A. Faught, M.D. Seventh Edition. Pp. xii + 523. Philadelphia: F. A. Davis Coy. 1921. Price $4.50 net.

This will be found a useful guide to modern methods of laboratory diagnosis in clinical medicine. The author has introduced chapters dealing with the chemistry of the blood (urea, sugar, N.P.N. estimations, etc.) and with renal efficiency tests. The chief criticism to be offered is as to the number of alternative methods described; the beginner will often be at a loss which to select. A more thorough revision would

have led to the elimination of some methods which are now almost obsolete, *e.g.*, the estimation of the specific gravity of the blood by the pycnometer, counting blood platelets, and the older tests for the blood reaction. A not unimportant flaw in the book is the occasional omission to state the normal finding; we failed, for instance, to discover the normal content of blood urea. It is a pity that an otherwise useful book should not have been more carefully revised.

Practical Physiological Chemistry. By PHILIP B. HAWK, M.S., Ph.D., Seventh Edition. Pp. xiv + 674. London: J. & A. Churchill. 1921. Price 24s. net.

This is a more comprehensive book than its title would imply, for in addition to being a practical handbook for students taking a laboratory course of physiology, it really deals very fully with physiological chemistry as a whole in a way which is more than ample for any student. This edition has been thoroughly revised; the methods of blood examination of Folin and Wu are described, vitamines are discussed at length, and a chapter on Respiration and Acidosis has been added. It seems hardly necessary nowadays to describe the cryoscope in a book of this kind, and in general it errs perhaps on the side of over elaboration, bearing in mind the class of readers for whom it is intended, but it is a good and comprehensive guide and work of reference for the advanced student.

NOTES

Summer Graduation.

AT the Graduation Ceremonial held at Edinburgh on 21st July, the Vice-Chancellor conferred the Honorary Degree of *Doctor of Laws* on Sir Isaac Bayley Balfour, Sir J. Halliday Croom, Sir Charles S. Sherrington, and Dr John Thomson.

The degree of *Doctor of Medicine* was conferred upon twenty-six candidates; Dr James E. M'Cartney was awarded a *Thesis Gold Medal.* Mr Walter Quarry Wood obtained the degree of *Master of Surgery* and was awarded a *Thesis Gold Medal.*

One hundred and forty-two candidates graduated *M.B.*, *Ch.B.*, and twelve obtained the *Diploma in Public Health.*

The following awards were made:—*The Cameron Prize in Practical Therapeutics* to Frederick Gowland Hopkins, M.A., M.B., D.Sc., F.R.S., Professor of Bio-Chemistry in the University of Cambridge. *The Syme Surgical Fellowship* to Norman M'Omish Dott, M.B.,

Ch.B. *The Gunning Victoria Jubilee Prize in Pathology* to James E. M'Cartney, M.D. *The Gunning Victoria Jubilee Prize in Physiology* to Eric H. Ponder, M.B., Ch.B. *The Ettles Scholarship and Leslie Gold Medal* to Joseph Owen Kennedy, M.B., Ch.B. *The Allan Fellowship in Clinical Medicine and Clinical Surgery* to Bruce M. Dick, M.B., Ch.B. *The Stark Scholarship in Clinical Medicine* to Adam Cairns White. *The M'Cosh Graduate's and Medical Bursaries* to Harold Keith Corkill, M.B., Ch.B. *The Beaney Prize in Anatomy and Surgery* to Bruce M. Dick, M.B., Ch.B.; Thomas M'W. Millar, M.B., Ch.B.—equal. *The Mouat Scholarship in the Practice of Physic* to Carl Hercules Fouché, M.A., M.B., Ch.B. *The Conan Doyle Prize* to Carl Hercules Fouché, M.A., M.B., Ch.B. *The Annandale Gold Medal in Clinical Surgery* to Ian Gordon Cameron, M.B., Ch.B. *The Buchanan Scholarship in Gynecology* to Bruce M. Dick, M.B., Ch.B. *The James Scott Scholarship in Midwifery* to Florence L. Telfer, M.B., Ch.B. *The Scottish Association for Medical Education of Women Prize* to Jessie Eeles, M.B., Ch.B. *The Dorothy Gilfillan Memorial Prize* to Jean M. T. Connochie, M.B., Ch.B. *The Wellcome Medals in the History of Medicine.—Gold Medal* to Thomas Ferguson, M.B., Ch.B.; *Silver Medal* to Frances Agnes Redhead. *The Pattison Prize in Clinical Surgery* to David Grieve. *The Wightman Prize in Clinical Medicine* to William R. Levie, M.B., Ch.B. *The Cunningham Memorial Medal and Prize in Anatomy* to Sidney Elisabeth Croskery, B.Sc. *The Whiteside Bruce Bursary* to George Brown.

Royal College of Surgeons of Edinburgh.

At a Meeting of the College held on 24th July, the following were admitted Fellows:—John Allison; James A. Berry; George S. Davidson; Donald G. Duff; William F. T. Haultain; William O. Lodge; James Macarthur; James M. Macpherson; V. Mahadevan; Humphrey I. Marriner; James B. Morrison; Frederick F. Petersen; Margaret S. Purce; William Waddell; Walter O. Walker; Chik Hing Wan; Matthew White; Robert H. Williams.

Triple Qualification Passes.

At the Examinations held at Edinburgh in July, of eighty-one candidates entered for the First Professional examination twenty-five passed; and of 123 entered for the Second and Third Professionals fifty-one passed. The following candidates passed the final examination and were admitted, L.R.C.P.E., L.R.C.S.E., L.R.F.P. & S.G.:—William H. Lloyd-Wronsley; Chong Tak Nam; Arthur K. Tateson; Algernon

Books Received

C. A. Fernando; Max G. L. Lucas; John M. Somasundrum; William A. B. Clark; Malcolm Macleod; Morris Witkin; Charles W. de Villiers-Pritchard; Agnes T. Martin; William A. M. Stewart; Herbert J. Appleyard; William Gray; William D. Oswald; Ian B. Cummings; and Henry G. F. Cubitt.

BOOKS RECEIVED

BALLANCE, Sir CHARLES A. History of the Surgery of the Brain (*Macmillan & Co., Ltd.*) 10s. 6d.

CROCKET, J. Physical Examination of the Chest (*H. K. Lewis & Co., Ltd.*) 9s.

HART, Mrs ERNEST. Dishes for Diabetics (*John Bale, Sons, & Danielsson, Ltd.*) 2s. 6d.

HEPBURN, MALCOLM. The Ophthalmology of General Practice (*Cassell & Company, Ltd.*) 12s. 6d.

HILTON-SIMPSON, M. W. Arab Medicine and Surgery (*Oxford University Press*) 10s. 6d.

INTERNATIONAL CLINICS. Vol. II., 1922. (*J. B. Lippincott Co.*) 42s. per Set of Four Vols.

KENNETH, JOHN H. Osmics: The Science of Smell (*Oliver & Boyd*) 2s.

KERR, J. M. MUNRO. Clinical and Operative Gynæcology (*Oxford Medical Publications*) 50s.

LAURENS, GEORGES. (Translated by H. Clayton Fox.) Oto-Rhino-Laryngology. Second English Edition (*John Wright & Sons, Ltd.*) 17s. 6d.

LUYS, GEORGES. (Translated by Arthur Forester.) A Text-book of Gonorrhœa. Third Edition . . . (*Bailliere, Tindall & Cox*) 21s.

POWELL, W. WYNDHAM. The Wyndham Powell Aero-Urethroscope (*John Bale, Sons, & Danielsson, Ltd.*) 2s. 6d.

PRIDE, ALWYN. Overseas Visitors' Guide to London and the British Isles (*Forster, Groom & Co., Ltd.*) 1s. 6d.

SIMON, E. D., and MARION FITZGERALD. The Smokeless City (*Longmans, Green & Co.*) 1s. 6d.

SINGER, CHARLES. The Discovery of the Circulation of the Blood (*G. Bell & Sons, Ltd.*) 1s. 6d.

TRANSACTIONS OF THE AMERICAN GYNECOLOGICAL SOCIETY. Vol. XLVI., 1921.

TRANSACTIONS OF THE AMERICAN PEDIATRIC SOCIETY. Vol. XXXIII., 1921.

TRANSACTIONS OF THE AMERICAN SURGICAL ASSOCIATION. Vol. XXXIX., 1921.

WILLIAMSON, A. MAXWELL. Annual Report of the Public Health Department of the City of Edinburgh for the year 1921. (*Hugh Paton & Sons, Ltd.*)

Edinburgh Medical Journal

October 1922

NOTE ON STHENIC DYSPEPSIA— "HYPERCHLORHYDRIA."

By J. J. GRAHAM BROWN, M.D., F.R.C.P.E., lately Senior Lecturer on Clinical Medicine, University of Edinburgh.

CONTENTS.

Introductory observations, *p.* 161
Types of nervous dyspepsia, *p.* 162
Para-sympathetic activities, *p.* 163
Motor gastric functions, *p.* 163
Peristalsis, *p.* 163
Postural activity, *p.* 164
Vagal efferent neurones, *p.* 164
Effects of para-sympathetic stimuli, *p.* 165
Hunger pains, *p.* 165
Clinical aspects of vagal hypertonus, *p.* 168
Note regarding gastric ulcer, *p.* 169
Effects of morphia, *p.* 169
Rapid emptying of stomach, *p.* 171
Extrinsic causes of gastric spasm, *p.* 171
Mechanism of vomiting, *p.* 172
Clinical aspects of vagal hypotonus, *p.* 175
Effects of atropine, *p.* 176
Sympathetic stimulation, *p.* 176
Congenital hypertrophic stenosis of pylorus, *p.* 177
Secretory functions, *p.* 178
Pavlov's experiments, *p.* 179
Influence of vagus, *p.* 180
Adequate stimuli, *p.* 180
Carlson's experiments, *p.* 181
Acidity of gastric juice, *p.* 182
Secretory functions—continued
Influence of sympathetic neurones, *p.* 184
Achylia, *p.* 186
Clinical aspects, *p.* 189
Results of para-sympathetic hypertonus, *p.* 189
Symptoms, *p.* 190
General clinical picture, *p.* 191
Onset of pain, *p.* 191
Other symptoms, *p.* 192
X-ray examination, *p.* 193
Test-meal, *p.* 194
Diagnosis, *p.* 196
Data, *p.* 197
Direct tests, *p.* 197
Gastric dilatation in advanced cases, *p.* 199
Treatment, *p.* 200
Lowering the tone of the vagus, *p.* 202
By increasing the sympathetic tonus, *p.* 202
By medicinal means, *p.* 204
Neutralisation of the gastric contents, *p.* 205
By increasing the saliva, *p.* 206
By antacid remedies, *p.* 207
Diet, *p.* 207

ONE of the finest and most experienced clinicians whom it has been my good fortune to know, stated as his reasoned opinion (1), that the great majority of cases of gastric disorder coming under the notice of the physician are originally of

nervous origin, whatever complications may have been implanted subsequently on the primary disturbance.

The minority may be taken as consisting of organic diseases, such as malignant disease or the results of swallowing irritant or corrosive poisons. Perhaps to these may be added the effects of direct toxic action, and certain dietetic disorders, especially those resulting from the consumption of indigestible and tainted food. Thus, in considering the causation and the treatment of disease of the stomach, it is essential that the physiology of gastric activities should be clearly understood and that the clinician should have recourse to the experimental findings of the laboratory, in order to clear up points in symptomatology otherwise obscure. The mere study, in cliniques, of the symptoms arising in human subjects must remain almost ridiculously futile without the sure foundation of physiological knowledge. The two lines of research—physiological and clinical—should be worked faithfully together, those concerned realising that each research will to a considerable extent supply the deficiencies of the other.

The great majority of gastric disorders, then, must be regarded as essentially of nervous origin. This being so, these disorders fall naturally into two groups; for the innervation of the stomach is two-fold—sympathetic and para-sympathetic—the one leading to atonic, the other to hypertonic conditions. This statement requires quite definite modification, as will be seen in the following pages.

The balance of these two great autonomic systems may be upset in several ways, with corresponding alterations in gastric functions. The activities of one may become depressed from various causes, toxic or other. In this case it follows that the clinical signs of dominance of the other will appear. Or, conversely, one system may be hyper-stimulated and so overpower the other. The subject before us is thus extremely complicated, and the object of the writer is to disentangle, in so far as he is able, the various possible complexes of symptoms which may meet the physician with a view to their appropriate treatment. This task, he is well aware, is no light one, but in direct proportion to its difficulty stands its importance.

As regards sthenic dyspepsia—the subject here under special consideration—the dominant division of the autonomic system is the para-sympathetic. It is therefore necessary to

consider in some detail the functions of that great set of neurones and the results which follow their stimulation—normal or abnormal as the case may be.

The activities of the stomach in so far as they are controlled by efferent para-sympathetic neurones in the vagus, are mainly (1) motor and (2) secretory. In the course of his work, the physician may meet with signs of disturbance of either of these separately, but more usually the symptoms in such cases point to involvement of both, to a greater or lesser degree. For the most part therefore a description of the clinical disorders, so produced, will not be given until the disturbances of gastric function have been considered.

Motor Gastric Functions.—The motility varies in different parts of the stomach. Normally, the fundus plays a more or less passive rôle, acting chiefly, according to Cannon (2), as a receptacle for food. It is not, however, entirely quiescent, for, even in quiet digestion there is some peristalsis there (3) though probably very slight in degree. Indeed, it can be but slight, for Scheunert (4) and others (5) have shown that various articles of food, when swallowed in sequence, form layers or strata in the stomach, and that this separation persists for hours during normal digestion. On the X-ray screen when one is examining a patient in the upright posture after a bismuth meal, the summit of the fundus is seen to contain air or other gas. The more or less complete quiescence of this portion of the stomach is not always maintained, however, for in the act of vomiting its fibres usually pass into strong contraction.

But normally the active peristaltic movements excited by the presence of food commence in the pre-pyloric region and increase in intensity as they sweep onwards to the pylorus. At the transverse band—the sphincter antri pylorici—the contraction of the muscular fibres may be very powerful, while at the pylorus itself the layers of smooth muscle are definitely increased, so that this very important sphincter is capable of closing firmly and so shutting off the stomach from the intestine at times when it is undesirable that the gastric contents should pass onwards. The closure of the pylorus is, however, a sympathetic, not a para-sympathetic, function.

As has been said, the fundal portion of the stomach acts as a receptacle for food. For the purpose of receiving the very considerable quantities which reach it suddenly from the œsophagus, it possesses remarkable postural activity, as Sherrington has shown (6). It is thus able to accommodate itself to sudden increase of food-content, with almost no change in intra-gastric pressure. The figures he gives bear this out in a very striking way, both as regards quick filling and quick emptying of the viscus. There is, however, as we shall see presently, a limit to its powers of accommodation under pathological conditions and in connection with the mechanism of vomiting.

The stimuli by means of which the para-sympathetic system controls gastric motility, pass to the stomach through both vagal nerves, the right vagus reaching in the first instance the lesser curvature, the left the greater. Spreading over the stomach wall, the terminal fibres of these pre-ganglionic neurones form synapses with the plexus of Auerbach which lies between the muscular coats of the stomach. This plexus represents the post-ganglionic neurones of the para-sympathetic system and the axones of its cells pass to the smooth muscle of the gastric wall forming myo-neural junction with its fibres. Recent observations by Langley (7) indicate that the efferent vagal connections with the stomach are tri-neuronic and not bi-neuronic as is usually the case with other autonomic nerves. The development of Auerbach's plexus has been carefully studied by Miss Meiklejohn (8) and is of exceptional interest.

It has long been known that electrical stimulation of the vagus is followed by contraction of the muscular coats of the gastric wall. Even stimuli which are so weak as hardly to disturb the action of the heart (9) are capable of producing strong peristaltic waves which get more and more powerful as they proceed towards the pylorus. Moreover, as Miller (10) has found, stimulation of the central end of one cut vagus (the other being intact) causes salivation and vomiting.

These results have been obtained in animal experiments, but a similar action may be demonstrated in the human subject when the vagal terminations are stimulated by means of pilocarpine. In Figure 1 will be found tracings taken from reduced photographs of X-ray plates. In this case (Miss C. D.) the effect of pilocarpine on a dilated stomach is apparent.

But, while para-sympathetic impulses cause contraction of

the gastric wall, their effect on the two sphincters which lie at the upper and lower level of the stomach is of a converse nature. We know that vagal stimulation causes the cardia to relax in the act of swallowing. The effect on the pyloric sphincter is similar, as Elliot ([11]) has shown, inhibition following such stimulation. As regards the antral sphincter, in strong vagal stimulation, such as occurs in vomiting, the contraction of the gastric wall is so intense at that point as to close the lumen of the viscus, thus separating more or less completely the pyloric antrum from the body of the stomach.

Though strong peristalsis is produced by vagal stimulation these waves may and do occur independently of such central para-sympathetic impulses, for a stomach completely cut off

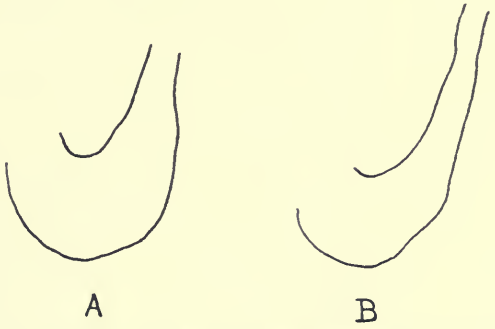


FIG. 1.—Tracings from reduced X-ray Photographs of Stomach—A before, and B after the administration of Pilocarpine.

from the higher centres by section of all its nerves, will, under favourable conditions, exhibit distinct peristaltic contractions. Certain observations of Cannon appear to suggest that these rhythmic movements are myogenic in origin. If this be so we may perhaps look upon such local mechanism as being regulated by the "nodal tissue" described by Keith ([12]) as lying close to the cardia. But, in normal conditions, such local mechanism as this would functionate only under the control of higher centres.

The pains or pangs of hunger felt by a fasting man, which have been so carefully investigated by Cannon and Washburn ([13]) and by Carlson ([14]) ([15]), are undoubtedly the direct result of peristaltic contractions of the empty stomach. These pains are not constant but come at intervals and it has been shown with clearness that the more severe the pain, the stronger is the contraction which has occasioned it.

The clinical importance of the subject seems to make it desirable to study this question a little more fully here, for it is evident that there must be other and important factors behind the mere local gastric condition (or change in condition) which sets up the afferent stimulus leading to pain. These hunger-contractions owe their origin to the same mechanism as does the peristalsis of normal digestion, that is, they are under para-sympathetic control, and, like the latter, they are increased by pilocarpine and inhibited by adrenaline ([16]). It has often been observed that such smooth muscle as is innervated by para-sympathetic neurones shows more activity at night than during the day, and, as we might therefore expect, the pains of hunger are most acutely felt at night. Even during sleep they may occur, and the writer has noticed that when circumstances have led to the evening meal being unusually scanty, dreams of food may arise during the night or in the early morning, no doubt due to such hunger contractions as those we are dealing with. This is probably not an uncommon experience.

The disagreeable or painful sensations to which gastric hunger-contractions give rise, are transmitted by afferent vagal neurones to the medulla and thence onwards to the cortex, though the localisation there is quite unknown. Indeed it seems likely that the greater part, at all events, of the perception of hunger originally takes place in the basal ganglia, for hunger is bio-logically a very primitive sensation and one of the most fundamental in relation to the preservation of the organism. We know that such phylogenetically ancient perceptions—for example, sight—were originally perceived in the basal ganglia, and that the power of perception was taken over by the cerebral cortex, only when that cortex, in the course of development, became dominant. Thus, a de-corticated pigeon is able to select its perch and to alight on it with accuracy; and a rabbit, after a similar operation, avoids with ease obstacles which it may meet with in its path. In both instances, therefore, some perception of sight remains in the basal ganglia. This view of the subject was carefully elaborated by Lewandowsky ([17]).

We are, however, now dealing with hunger—an even more ancient sensation phylogenetically than sight—and here we shall find our best illustration if we take the classical case of the dog on whom Goltz ([18]) operated so successfully in removing the whole of the cortex. In that animal there can be no doubt that the sensation of hunger was still acutely perceived. And we

may, I think, take it that in man also the perception of hunger still remains to some slight extent in the basal ganglia.

But, beyond this, there must be some other factor which gives rise to the sensation — a condition connected with inanition, indicating that the organism is not being sufficiently supplied with nourishment. This factor we find in the state of the blood, for if the blood of a starving animal is transfused into the veins of a normal animal, hunger-contractions are at once set up. The sequence of events would thus appear to be as follows. Blood, defective in nutritive material, circulating in the medulla, stimulates the efferent vagal neurones and thus gives rise to those contractions which produce the sensation of pain or at any rate of discomfort. The stimulus set up by these contractions passing by afferent neurones of the vagus, ultimately reaches the cerebral cortex, and is there perceived as hunger.

But, apart from hunger, other stimuli arising in connection with the stomach may pass the threshold of consciousness. To some of the more powerful of these, reference will be made later. There are, however, one or two which may be suitably noticed here. Undoubtedly, unwonted stretching of the viscus is the cause of that feeling of fullness which is perceived especially by a schoolboy at Christmas after a copious repast. One such youth, painfully replete, is said to have expressed regret that in his opinion he had no space left for pudding, except that provided by his neck.

The gastric mucosa is devoid of tactile sense. There must, however, be receptors there attuned to changes in temperature, for when hot or cold water reaches the stomach the difference may be felt. The action of alcoholic beverages on gastric motility is peculiar. When these are introduced into an empty stomach, the result, so far as hunger pains are concerned, is one of inhibition of these contractions, and this inhibition lasts for a considerable time. If, however, food is present this result does not obtain. As we shall see later the taste of wine in the mouth arouses appetite and leads to the secretion of gastric juice.

Hunger-contractions, as has been said, are arrested by adrenaline, and in presence of any strong emotion such as fear or rage all sensation of hunger ceases. In animals it has been shown that this inhibition is due to excitation of sympathetic neurones, for it does not occur if the splanchnics

are cut. Indeed, if this operation is performed, the para-sympathetic stimuli dominate and gastric contractions increase in force.

Turning now, more particularly, to the clinical aspects of para-sympathetic motor innervation of the stomach, we have in the first place to recognise that in certain persons, from inborn hereditary causes, the tonus of the vagus is unusually high. This hyper-tonus may be absolute, or only relative in that the sympathetic tone is low and therefore the normal balance of the two systems is upset. In persons of this constitution, the wall of the stomach will be more or less hypertonic and the tonus of the pyloric sphincter rather lower than the average. The tendency will thus be to a more rapid emptying of the stomach, though this will be governed by other factors to be mentioned presently.

Before we consider the various pathological conditions fitted to cause a distinct reflex stimulation of vagal neurones and consequent alteration in the motility of the stomach, there are two causes of gastric spasm not so directly connected with para-sympathetic innervation, the one frequent, the other less common, which ought to receive preliminary notice; in these, the reflex is sometimes purely local, taking place in the stomach wall itself. The first of these is gastric ulcer. In this case the area of smooth muscle involved in the spasm may be very limited, leading to an hour-glass contraction. The irritation of a cancerous growth may produce a like local effect. In both these cases, an X-ray examination, considered along with the symptoms presented by the patient, will guide the physician to a correct diagnosis. Neither of these forms of local gastric spasm has been definitely shown to be due to reflexes passing by vagal neurones, although we may well assume that this is so.

But in the case of such an ulcer, the irritation is often so great as to cause not merely a local but a generalised spasm of the gastric wall, the contractions then due to vagal reflex stimulation, spreading over the pyloric antrum and even over the whole viscus ([19]). The characteristic pain which is experienced in such cases results from the irritation produced by these powerful peristaltic waves as they sweep over the ulcerated point. There is doubtless, in addition, a state of hyper-excitability in the afferent nerve-endings of the part affected. Not uncommonly the stimulation of such afferent neurones is sufficient to produce, not merely reflex gastric

spasm, but actual vomiting. The pain which these peristaltic waves excite in cases of ulcer may be alleviated by paralysing the post-ganglionic vagal neurones by means of belladonna or its alkaloid.

Two other points may be mentioned in this connection as being of special clinical interest. There is some evidence tending to show that the causation of gastric ulcer (and perhaps of duodenal ulcer also) has a peculiar connection with para-sympathetic tonicity, when that system becomes dominant from diminution or absence of sympathetic stimuli. Mann ([20]) has found, from experiments made in connection with the Mayo clinic, that acute gastric ulcer involving the muscular layer as well as the mucosa occurs in about 90 per cent. of animals dying from acute adrenal insufficiency. Gundelfinger ([21]), as the result of clinical observation as well as of animal experiment, comes to a similar finding. That relative domination of the para-sympathetic may be a cause of acute gastric ulcer, is even more precisely shown in the results of the experiments of Elliot ([22]). By giving tetrahydro-β-naphthylamine to guinea-pigs he produced that rapid exhaustion of adrenaline from the supra-renal glands which the drug is known to cause. Consequently the sympathetic tonus fell, the para-sympathetic became dominant, and acute gastric ulcers formed in the animals so treated. Although Katayama's more recent observations ([23]) give less conclusive results, the whole evidence is undoubtedly suggestive and certainly interesting.

A second point in regard to gastric ulcer which possesses some clinical importance arises in connection with the treatment of hæmatemesis. The first thing the physician usually does in such a case is to give a dose of morphine hypodermically. His main purpose is to tranquillise the patient, to remove her anxiety, and to check the restlessness which is apt to follow loss of blood. These objects are quickly attained if a sufficient dose be given. A further purpose which the drug is supposed to serve is to still all gastric movements. In one sense, perhaps, it may be said to do so; but the action of full doses of morphine on the stomach is peculiar. Magnus ([24]) has shown that in the rabbit, the cat, and the dog, morphine causes the pyloric portion to pass into violent spasm. The fundus remains relaxed but the pyloric and the antral sphincters are tightly closed. In man, especially in youngish people, the same action occurs, though not to so marked an extent. This spasmodic contraction,

which in the circumstances is painless, obviously favours arrest of hæmorrhage if the ulcer is situated within the area of spasm. The edges of the ulcer are thus brought towards each other and the bleeding vessels compressed. It is chiefly in this way, I believe, that the beneficial action of the drug is brought about. The dose must however be a full one, and the patient should be kept more or less under the influence of morphine for several days. It is to be noted that while this effect is produced by morphine, one of the members of the phenanthrine group of opium alkaloids, derivatives belonging to the iso-quinoline group produce an opposite effect, papaverine in particular causing relaxation of the gastric wall, and acting in this respect much as atropine does. Its beneficial action in bronchial spasm I have myself observed.

Another cause of gastric spasm is to be found in any morbid process which produces a more or less complete obstruction of the pyloric orifice—most commonly the result of gastric or duodenal ulcer, or of carcinoma in that region. In such cases, when food enters the stomach very marked peristalsis shows itself, the waves being much deeper and more frequent than normal. This heightened peristalsis is due to vagal reflexes, the stimulus arising in the stomach walls as the result of stretching. It seems likely that a corresponding excitation may be produced by products of decomposition in the stomach, its contents having been retained too long in the fundus. The gastric hypertonus of pyloric obstruction lasts a variable time, but ultimately, when the patency of the orifice is nearly obliterated, gastric dilatation becomes very marked indeed, and then little or no peristalsis can be observed, the food lying quiescent in the greater curvature of the stomach.

These conditions are largely mechanical in their origin. There is, however, another cause of pyloric stenosis, leading to gastric spasm, which, though also mechanical in the obstruction it produces, is much more interesting from the point of view of gastric innervation, namely, congenital hypertrophy of the pylorus. This subject will be considered more appropriately later.

In connection with the strictly localised gastric contraction which occurs frequently in cases of gastric ulcer and of carcinoma, it was pointed out that this form of spasm may perhaps be due to a local reflex (possibly axonic) and not to one passing by the main para-sympathetic system. It is

certainly otherwise with regard to gastric spasm caused by irritation in more or less distant organs. There, the efferent vagal neurones undoubtedly form part of the reflex arc. The most common starting-point of these reflexes is a duodenal ulcer. In this condition the gastric spasm is usually considerable, the stomach often assuming an hour-glass shape. The incisura is deep, and the peristaltic movements, sweeping onwards to the pylorus, strong and vigorous. In certain cases the cavity of the ulcer, filled with bismuth, may reveal itself distinctly on the screen or in the photograph.

A rapid emptying of the stomach, and a correspondingly rapid passage onwards of the bismuth-meal, is another sign of the presence of duodenal ulcer and possesses great importance for diagnostic purposes. In one patient, Mrs T., suffering from this condition, I saw the bismuth reach the lowest coils of the ileum in the remarkably short time of half an hour. To explain this phenomenon, we must remember that the irritation of the ulcer, in stimulating the vagus, causes not only heightened gastric contraction but also inhibits the pyloric sphincter. That orifice, therefore, is unusually patent, and the stomach contents, propelled with vigour, pass onwards with abnormal ease. This is not, of course, seen in cases in which the ulcer has produced obstruction. In such instances there is marked retention of the stomach contents along with heightened peristalsis.

More remote causes of reflex gastric spasm may be considered briefly. It is seen in cases of disease of the gall-bladder, and, more pronouncedly, during an attack of biliary colic, where it may show itself in the extreme form of violent vomiting ([25]). The same reflex may be excited by the passage of a renal calculus down the ureter. Acute and chronic appendicitis may have a similar reflex effect, and other abdominal lesions likely to produce it, such as acute obstruction, will occur to the reader. The gastric crises of tabes are probably of vagal origin.

It is useful to remember that gastric spasm produced by such chronic conditions as disease of the gall-bladder and subacute or chronic appendicitis, may be removed for the time by blocking the vagal efferent stimuli by means of belladonna or atropine. Such reflex spasm may thus be distinguished clinically from the strictly local spasm of gastric ulcer, which does not, as a general rule, yield to belladonna or its alkaloid.

As regards gastric spasm resulting from sub-acute or chronic appendicitis, probably the most distinct diagnostic sign is the discomfort or hyperalgesia, in the epigastric region, which results from pressure over the appendix.

At this point we may usefully consider the mechanism of vomiting, a reflex act essentially para-sympathetic in its nature, and one of the most important safeguards which the organism possesses. As many of those who have suffered the pangs of sea-sickness know, an early sign of its approach is an out-pouring of saliva. It would thus appear that the first para-sympathetic neurones to be affected are those, medullary in their origin, which convey stimuli from the superior and inferior salivatory nuclei to the glands in question. After this salivation, there follows a feeling of nausea and then the gastric contents are evacuated.

The mechanism by means of which this evacuation is brought about is very complex, for striated as well as smooth muscles are engaged. The former are essentially those of respiration, the diaphragm and the abdominal muscles; and it is noteworthy that while the diaphragm is a muscle of inspiration, the muscles of the abdominal wall are expiratory in function. It would thus appear that neurones regulating both phases of respiration are stimulated simultaneously—a remarkable synergy.

The smooth muscles concerned in this very complicated reflex are vagal in innervation. As a result of para-sympathetic stimuli the pyloric antrum is thrown into a state of spasm, thus forcing its contents into the fundus, and the sphincter antri contracts so tightly as to shut off the pyloric portion more or less completely from the rest of the stomach. Meanwhile, by its inhibitory action, the vagal stimulus has caused the cardiac sphincter to relax. The fibres of the fundus contract at the same time, to some extent, and between the descending diaphragm and the tightened abdominal muscles the stomach is so compressed that its contents are forced up the œsophagus. The glottis is simultaneously closed and usually the nasal cavity is also shut off by the contraction of the soft palate.

The path of this reflex is complex. If we take the commonest cause of vomiting—irritation of the gastric mucous membrane—the stimulus proceeds to the medulla by afferent fibres of the vagus ([26]). The excitation then passes, on the one hand, to the nucleus of Staderini to stimulate the efferent neurones of the vagus, on the other to the nucleus of the tractus solitarius.

Thence, through the solitario-spinal tract, it reaches the phrenic nucleus and the spinal nuclei from which motor nerves proceed to the abdominal muscles.

It seems highly probable, though absolute proof would be difficult to obtain, that the vagal efferent stimuli essential to vomiting are not confined to those proceeding to the gastric wall, but that the bronchial musculature is also thrown into contraction at the same time. We all know how useful an emetic may be, especially in children, when there is a dangerous accumulation of secretion in the air-passages. In the act of vomiting much of that secretion is expelled. As we know from actual experiment a bronchus may contract to one-third of its diameter under stimulation of the vagus, and it is not unreasonable to assume that this contraction aids materially in the expulsion of mucus in such cases.

The methods whereby the act of vomiting may be brought about are many, and it is not intended here to attempt an enumeration. A few examples may suffice to indicate the various sources from which adequate stimuli arise. Receptors in the gastric wall form the most usual starting-point. These may be stimulated sufficiently to set up the reflex act, by irritating and corrosive poisons, by emetine and other emetics, and by the products of the decomposition of food, either before ingestion or while it is lingering in a dilated stomach. To the vomiting which occurs in cases of gastric ulcer and in carcinoma, allusion has already been made.

In speaking of the special adaptability of the gastric wall to sudden increase in the volume of its contents—its postural activity—it was pointed out that this does not always obtain under pathological conditions. One of these conditions is that of extreme stretching, such as may occur in cases of dilatation. The most striking, though not the sole, example of this is to be found in cases of pyloric obstruction. In such circumstances the only way in which the stomach can find relief is by the act of vomiting. When the pressure and stretching has reached a certain degree [in the dog, Kelling ([27]) fixed this at a pressure of 25 cm. of water] vomiting occurs, with great relief to the patient. The same result is seen in cases of marked atony of the stomach from other causes. In these cases the use of the stomach-tube is usually advisable.

Such are some of the ways in which the act of vomiting may originate from stimulation of receptors in the gastric wall, but

the reflex may be excited at higher or lower levels of the alimentary tract. The result of tickling the posterior wall of the pharynx is an example of the first of these. Many instances of the latter will occur to the reader, for receptors of a similar order to those in the gastric mucosa are found throughout the abdomen, and vomiting may result from such sources of stimulation as have been noted above as possible causes of gastric spasm. These include cases of biliary and renal colic, of appendicitis and of intestinal obstruction. Reflexes from the pelvic organs may likewise induce vomiting.

But receptors which on excitation produce the reflex act of vomiting, are not confined to those in the alimentary tract or to those connected with pelvic viscera, for almost any severe bodily injury may initiate the reflex. Moreover, one of the most striking ways in which it occurs is in connection with derangement of the labyrinth. Perhaps the most severe series of attacks of persistent vomiting which I have ever seen, and certain of which lasted for many hours, was in a lady of fifty, the subject of Ménière's disease. In this case sedatives had but little effect, and the only way in which even partial relief could be obtained was when her maid, leaning over the bed, held my patient's head firmly in the median position on the pillow. The close connections of the vestibular division of the eighth cranial nerve with Deiters' nucleus and with the cerebellum, probably account for the persistent and severe vomiting which is one of the signs of lesion in that part of the brain.

Apart from these peripheral causes, the act of vomiting may be produced by direct action on the centres in the medulla which govern the reflex. The best example of this is to be found in the effect of hypodermic injection of apomorphine. That this drug is central in its action, is shown by the fact that it is difficult to produce vomiting by its oral administration, very large doses being required—twenty times greater, it is said, than that used with effect subcutaneously. Another proof of its central action is furnished by the observation that the local application of apomorphine to the medulla causes vomiting.

The gastric disturbance and even vomiting which sometimes follow the use of digitalis is also central in origin, and so, in all likelihood, is that occasionally resulting from the administration of morphine. This latter effect is usually avoidable if a small dose of atropine is given at the same time.

To a more or less direct action on the medullary centres may be attributed the vomiting which follows various forms of injury to the head—the reflex being initiated either by changes of intra-cranial pressure or by disturbance of the circulation in the medulla. Probably both of these factors are present in many such cases, as, for example, when a brain tumour is growing more or less rapidly. The vomiting of uræmia is also central in its causation.

The close association of the respiratory centre with the reflex act we are considering and with the vagal nuclei, probably accounts for the fact that severe paroxysms of coughing are so often followed by vomiting.

The excitation may also come from higher centres, for, at any rate in neurotic persons, the psychical impression caused by the sight, smell, or taste of something disgusting may start the reflex.

Up to this point we have been considering changes in gastric motility produced by stimulation of the vagus. It now becomes necessary to refer to what happens when such para-sympathetic efferent stimuli are removed or are diminished, either absolutely or relatively to those of the sympathetic. Here, as elsewhere, the antagonism between these two great autonomic systems shows itself prominently, for, while vagal stimulation causes contraction of the gastric wall and inhibition of the pyloric sphincter, sympathetic stimulation has an exactly opposite effect, the muscle of the wall being inhibited and the sphincter contracted. Thus, if the balance between these two great systems is over-set, we get one or other of the changes in gastric motility just mentioned.

Hitherto we have been dealing with the results of disturbance of that balance in one direction, namely, conditions of hypertonus of the para-sympathetic resulting in gastric spasm, etc. What will happen, what symptoms will emerge, if the balance is disturbed in the other direction, if (1) the para-sympathetic tonus is materially lowered, or if (2) the sympathetic tonus becomes abnormally high? In either of these two conditions the sympathetic will necessarily become dominant.

Section of the vagi retards the passage of food through the pylorus ([28]). It does this for two reasons, (1) because peristalsis ceases or becomes materially weakened, and (2) because the pyloric sphincter, having lost the vagal inhibitory influence, passes into abnormal spasm. Vomiting, so far as the stomach

itself is concerned, now becomes impossible, though on the administration of apomorphine the diaphragm and abdominal muscles still perform their part in the reflex act. According to the experiments of Auer ([29]), after bilateral sub-diaphragmatic section of the vagi in the rabbit, gastric peristalsis, at first completely lost, is regained, to some measurable extent at least though perhaps imperfectly, after two days.

In the human subject we can readily see the effect of removal of vagal impulses by giving atropine. Peristaltic movements are then no longer apparent on the X-ray screen, and the walls of the viscus having lost tonus, there is marked gastric dilatation. This result can be seen clearly in Fig. 2. We may expect to find in clinical work a corresponding

FIG. 2.—Tracings from reduced X-ray Photographs of Stomach—A before, and B after the administration of Atropine.

dilatation, though not always so extreme, and a retardation in the passage onwards of the gastric contents, in all cases, usually of toxic origin, in which vagal impulses have been weakened.

More commonly, however, in my experience, the balance between the two great autonomic systems is upset in the other direction, namely by domination of hypertonic sympathetic neurones. The result of stimulation of these neurones is to cause contraction of the pyloric sphincter ([30]) and inhibition of the muscle of the gastric wall. Adrenaline, given intravenously or subcutaneously, produces similar results ([31]).

The gastric dilatation and the gastroptosis seen in neurotic persons are usually traceable to sympathetic hypertonus, and a similar statement may be made as regards hyperthyroidism. In a recent paper in this journal, I gave details of the case of a girl suffering from the results of hypertonicity of the sym-

pathetic, and in Fig. 3 is reproduced a reduced tracing of the gastric dilatation which we found to be present in that patient. It will be remembered that under conditions of fear and of pain (2) the sympathetic is powerfully stimulated, and that as a result all gastric peristalsis ceases for the time.

I recently saw a case of sympathetic hypertonus, of an even more striking character, in a member of my own profession. In him, the right cervical sympathetic was much more definitely involved than the left. Both pupils were dilated, but the right was quite distinctly the larger. There was marked unilateral sweating on the right side of the face and neck, limited sharply at the middle line. He perspired profusely over the trunk, but there the action was not in any way unilateral. These symptoms

FIG. 3.—Reduced tracing from X-ray Plate taken in case described in text.

had existed for about a year before he consulted me. On a bismuth-meal being given, the body of the stomach was found to be dilated and atonic, while the pyloric sphincter was firmly contracted (see Fig. 4). This over-excitation of the sympathetic was traceable to the strain of the war, which in his case had been notably severe. So much was clear, but I failed to find any convincing reason why the right cervical sympathetic should have been affected so much more markedly than the left. Quite lately I have noticed the same unilateral difference in regard to the cervical sympathetic in several cases of neurasthenia, the result of "shell-shock." In them the signs were distinct, though not so striking as those mentioned above.

A consideration of the action of sympathetic stimulation in causing contraction of the pyloric sphincter, brings us back to the condition known as congenital hypertrophic stenosis of the pylorus, to which reference has already been made in connection

with gastric spasm. This disease of infants, so elaborately studied by John Thomson ([32] : [33]) is of singular interest. The important points, in relation to our present subject, are (1) extreme hypertrophy of the muscle-fibres at the pyloric sphincter; (2) the strong peristalsis of the stomach wall; (3) the persistent vomiting, and (4) the ultimate gastric dilatation and atony.

Thomson's view in regard to the etiology of this condition is undoubtedly correct, namely that it results from inco-ordination between the nervous mechanism of the pylorus and that of the stomach wall. Some have assumed that the pyloric spasm is due to adrenalism, but this cannot be maintained in the absence of other signs of over-action of that hormone. What appears to be a more likely view to take is to assume that those sympathetic neurones which innervate the pylorus are hypertonic from some unknown cause. We have seen, from the cases just mentioned, that there may be a localised stimulation of certain sympathetic neurones. This is, therefore, not an unreasonable assumption. Moreover, in some cases, Thomson has found a similar hypertrophy at the lower end of the œsophagus, and we know that the sphincter there contracts on sympathetic stimulation. Thus there seems to be evidence that the neurones of both these sphincters are acting powerfully, and that the muscle-fibres concerned are therefore hypertrophying. But this is not all, for the almost complete closure of the pylorus causes such serious obstruction that, as the stomach tries vainly to empty itself, strong reflex para-sympathetic stimuli result, vagal action is called into play, and violent peristalsis takes place. Ultimately, however, if proper treatment is not carried out, this peristalsis ceases and the over-strained stomach dilates, usually with fatal results. In such a case the sympathetic remains dominant to the end.

Having thus considered, in some detail, the phenomena, physiological and clinical, associated with conditions of gastric motility, we now turn to the second important function of the stomach, namely, secretion.

Secretory Functions.—The exact localisation of the varieties of secretory glands in the human gastric mucosa has recently been investigated by Miyagawa ([34]), to whose article the reader interested in the subject may be referred.

As regards the physiology of gastric secretion, the remark-

able series of experimental observations made by Pavlov ([35]) must always remain classical in scientific literature, and, so far as the results of nervous influence are concerned, not a great deal of knowledge has since been acquired, though the painstaking observations of Carlson ([16]) have cleared up many details previously obscure, and corrected certain errors in Pavlov's conclusions which had resulted from the fact that his investigations were confined to the dog.

So important were Pavlov's experiments and so far-reaching in their results, that some brief description of the methods he employed seems necessary at this point. In the dog, by very careful operative procedure conducted with elaborate aseptic

FIG. 4.—Reduced X-ray Photograph from case described in text.

precautions, a part of the stomach was completely isolated from the main body of the viscus so as to form a pouch or miniature stomach. Unlike Heidenhain ([36]), who performed a similar operation, Pavlov succeeded in maintaining intact the vascular and nervous supply to the pouch. This miniature stomach opened by a fistula on the skin surface, and thus the gastric juice secreted could be withdrawn readily for examination, both as regards quantity and quality. Careful investigation showed that the secretion of this pouch was an accurate and reliable index of the secretion of the stomach itself, the relative proportion usually being that of 1 : 10.

The observations made by Pavlov on animals after this procedure, and after another operation to be mentioned presently, were very numerous, were carefully designed to elucidate many

difficult points then quite obscure, and were wonderfully concordant in their several results.

The first flow of gastric juice occurring in connection with a meal is undoubtedly due to stimuli passing down the efferent para-sympathetic neurones of the vagus. By very careful experiment, Pavlov was able to show that stimulation of the peripheral end of the cut vagus produced a flow of this secretion. Great care was required in this observation, for the emotions of fear and of pain tend to inhibit secretion. But this inhibition he was able to avoid by the actual conditions of the experiment, which it is not necessary to detail here. That his conclusion was correct is, however, evident, for section of the vagi, or the blocking of vagal impulses by means of atropine, arrest that form of secretion of gastric juice.

We have now to ascertain what the stimuli are which are capable of exciting the vagus in such a way as to cause gastric secretion. They do not result from mechanical irritation of the mucous membrane of the mouth or from the mere act of chewing. Nor are they excited by similar stimulation of the lining membrane of the stomach. The only result of this last, so far as secretion is concerned, is an outpouring of mucus which forms a protective layer and is certainly one of the defensive reflexes of the organism. What then are the adequate stimuli by means of which gastric juice is secreted? To clear up this very important point, Pavlov had recourse to another operation. In dogs with an ordinary fistula he divided the œsophagus in the neck, so that the mouth was entirely cut off from the stomach. In such an animal the food chewed passed out by the opening in the neck. Five minutes after this "sham feeding" commenced, gastric juice was copiously secreted.

The results of such experiments as this, varied as they were in many ways, went to prove that the source of vagal stimulation was appetite, in one form or another. In the dog, and probably to a lesser extent in man, there is evidently a strong psychic influence, the mere suggestion of the preparation of food being sufficient to incite a flow of gastric juice. The sight and smell of food act also, but undoubtedly the most important stimulus is that of taste. The food given must be palatable. But, however delicious it may be, no secretion from the gastric mucous membrane results if the vagi have been previously cut.

That appetite is the exciting cause of the secretion of gastric juice is no new discovery, for Bidder and Schmidt ([37]) observed

the fact some seventy years ago, and the same results have been noticed by other more recent experimenters. But as regards the dog, nothing approaching the precision of Pavlov's experiments has been recorded. The phenomena which obtain in man are not necessarily similar in every detail to those found in the dog, and for the conditions which prevail in the human subject we have to rely chiefly on the patient, careful, and long-continued investigations of Carlson ([38]). He made use of a man in whom the presence of a complete but non-malignant œsophageal stricture had necessitated the operative formation of a gastric fistula through which he was fed. He was in good health and remained so, almost without exception, during the years he was under Carlson's observation.

On the whole, Carlson's results closely resemble those of Pavlov; there are however some important differences. The idea of food has not so strong an influence on the digestive glands in the human subject as it has in the dog. Fortunately, a man whose appetite is keen does not wander about the streets with copious and viscid saliva dripping from the corners of his mouth. Similarly, the flow of gastric juice in man is not so considerable from purely psychic causes. In him the main stimulus is, as has been noted above, the agreeable taste of the food and the attractive, I had almost said artistic, manner of its presentation. Yet it has been shown ([39]) that the suggestion of food to a man in hypnotic sleep will cause a flow of gastric juice.

In the dog, Pavlov noted that in "sham feeding" there was invariably a delay of five minutes before the appetite juice appeared. Carlson adduces convincing reasons which go to show that this interval is not a nervous phenomenon but is due to delay in the gland-cells themselves. The stimulus apparently reaches the gastric mucous membrane at once, but unless the glands there are already secreting, it takes some minutes before they can prepare the digestive juice and pass it into the stomach.

Carlson also found, contrary to the results of Pavlov's experiments, that the cavity of the normal stomach is never entirely without some gastric juice. That juice is small in quantity and of a low acidity, 0·2 per cent. or less; still its presence points to a certain constancy in the process of secretion. This probably accounts for the fact that dogs with double section of the vagus can digest after a few days and can do so apparently in a normal fashion.

The acidity of pure gastric juice, both in man and in the dog, is fairly constant. It varies little from 0·5 per cent., and it seems evident that this percentage of hydrochloric acid cannot be exceeded, however powerfully and in whatever way the vagus may be stimulated. A figure like this is of course much higher than that ever found clinically. The average acidity, that is of free and organically combined HCl, so found in a healthy man is about 0·2 per cent. Neutralisation must therefore have taken place in the stomach to an extent sufficient to reduce the acidity to less than half its previous degree. Apart from the dilution which the test-meal occasions, this change in reaction is brought about normally in three ways and from three different sources. The saliva is alkaline and its admixture tends therefore to reduce the acidity of the pure gastric juice. The same may be said of the mucus which is poured out from the glands in the gastric mucous membrane. These two alkaline fluids, then, diminish the acidity of the gastric juice in the cavity of the stomach, not only by diluting it but also by neutralisation; and clearly the greater amount of saliva and of mucus present, the more will the percentage of HCl fall. There is, however, a third factor which is fitted to aid in that process, for Boldyreff([40]), in his study of the self-regulation of the acidity of the gastric contents, has shown that this is in part effected by reflux into the stomach of the alkaline juices of the duodenum. If we could conceive of a case in which these three factors were absent and their neutralising effect consequently non-existent, we should find the gastric contents, as removed by the stomach-tube, to possess an acidity of about 0·5 per cent. Under no morbid condition, in my experience or within my knowledge, does so high a percentage occur. There is always a certain degree of neutralisation. This neutralisation may be less or it may be more, but it is invariably present in some measure, and, clinically, the acidity of the stomach contents never reaches that of pure gastric juice. The term "Hyperchlorhydria" is therefore not strictly correct([41]). The real meaning of the condition which goes so often under that name is that there has occurred a hyper-secretion of appetite juice from hyper-activity of the vagus. If this occurs, that is if an increased amount of gastric juice is secreted, both dilution and neutralisation will be below the average, and the percentage of acidity in the gastric contents after a test-meal, normally about 0·2 per cent., will rise to 0·3 per cent. or even higher, though it will never

reach the figure which the analysis of pure juice yields. The clinical symptoms and the treatment of this hyper-secretion will be considered presently.

The biological significance, or in other words the utility of the secretion of HCl in the stomach, is manifold. It activates pepsin, for without the presence of acid that enzyme cannot fulfil its work in digesting proteins. No doubt other acids, such as lactic acid, may act to a certain extent in the same way, but HCl is much more efficacious.

The presence of free HCl in the stomach forms one of the many safeguards the organism possesses. It acts as an antiseptic limiting to some measurable extent the invasion of the alimentary tract by pathogenic micro-organisms. Bacteria are being constantly swallowed along with food, and especially in saliva ([42]), and many of these, though not all, are destroyed in a medium even as weakly acid as the normal stomach contents. Hydrochloric acid possesses another very important function, for it exerts a local control over the opening and closing of the pyloric sphincter ([43]). Acidity of the contents of the pyloric antrum leads to relaxation of the sphincter, while the same reaction in the duodenal contents causes the sphincter to close until neutralisation has been effected. This reflex acts through a local para-sympathetic mechanism, the plexus of Auerbach, for if the serous and muscular coats between the duodenum and the pylorus are severed, the effect does not occur.

There is, however, another cause producing secretion of gastric juice, and one which is, so far as we know at present, altogether independent of central nervous control. It has been found that after the flow of appetite juice has ceased, a secondary though less important secretion occurs. The stimulus in this case is due to the presence, particularly in the pyloric antrum, of certain forms of food. Of these, meat extract may be taken as typical. This flow of gastric juice, often spoken of as "chemical secretion," may well arise, in part at least, by the agency of local plexuses in the stomach wall; indeed Sanotskii's observations (quoted by Pavlov) point to that conclusion. But in part this secretion seems undoubtedly to be due to the action of a hormone—gastric secretine or gastrine—for Edkins ([44]) found that a substance of this kind, formed in the mucous membrane of the pyloric antrum, caused a flow of gastric juice when injected into the

blood-stream. Similar extracts of other organs—liver, pancreas, etc.—appear to have a like effect ([45]).

To return to the question of central innervation in connection with the flow of gastric juice, it is evident that any increased activity of the efferent vagal neurones must tend to augment the secretion. Inherited para-sympathetic hypertonus, to which I have already referred, will have this effect, and if no increased neutralisation takes place, the acidity of the gastric contents will necessarily rise. Even more striking results of this kind may occur in connection with reflex stimuli such as are produced by gastric and duodenal ulcers, by appendicitis and by biliary colic. Nor must we forget that all drugs which stimulate the para-sympathetic system are capable of producing an increased secretion of gastric juice. Of these the most typical is pilocarpine. Choline and its derivatives are believed to have a similar effect. Histamine administered subcutaneously also gives rise to increased secretion. By careful and accurate adjustment of the dose, Rothlin and Gundlach ([46]) have been able to cause a flow of gastric juice exactly equal in quantity and quality to that produced by an ordinary meal.

But, as is seen in connection with autonomic mechanisms generally, there is another side of the problem and one which demands consideration, for secretion from the gastric walls is under sympathetic as well as para-sympathetic control. There is here, then, as is so frequently to be found elsewhere, a balance of these two forces and one which may from various causes be upset in either direction, whether temporarily or permanently. Para-sympathetic efferent impulses, as we have seen, are the agents by means of which the outflow of the very important "appetite juice" is brought about. Sympathetic impulses on the other hand inhibit gastric secretion, more or less completely.

Hitherto we have been considering the para-sympathetic causation of gastric secretion either in normal or in excessive amount. We have recognised that the adequate stimulus is to be found in the pleasure-giving sensations connected with appetite. Further, we have seen that over-stimulation and consequent over-secretion may be of hereditary origin, though probably it results more frequently from such reflex causes as those already mentioned. Nor must we forget that para-sympathetic impulses may dominate relatively where, for one reason or another, the sympathetic neurones have become

exhausted. Probably this occurs more frequently in the practice of the physician than is generally supposed. This condition has been referred to, by the writer, elsewhere (see "A Note on Asthma," *Edin. Med. Journ.*, February 1922).

But the balance of the two great autonomic systems may turn in the opposite direction, sympathetic stimuli dominating and the gastric secretion diminishing in amount or actually failing completely. This dominance may result in one or both of two ways: either the sympathetic may be over-active—in a state of hypertonus—or the vagal stimulus may be inhibited or depressed from actual lesion of toxic or of other causation. Probably these two factors—hypertonus of the sympathetic and hypotonus of the para-sympathetic—are present simultaneously in many cases.

The commonest cause of hypertonicity of the sympathetic is emotional excitement—for example, fear in the presence of danger. The result of this is an immediate suppression of gastric juice. As has been mentioned above, Pavlov, in ascertaining the effect of vagal stimulation in dogs, had to be extremely careful to avoid pain or alarm on the part of the animal, for if this occurred all gastric secretion was inhibited. Cannon, in his book ([2]), lays great stress on this process of inhibition as it occurs in man, and any physician can readily recall cases in which anxiety and grief had evidently inhibited gastric digestion. Indeed, the fact has long been known, for Beaumont ([47]), in the observations he made some ninety years ago in the case of Alexis St Martin, noted that fear and anger checked the flow of gastric juice.

A similar inhibition occurs when the sympathetic is stimulated by means of adrenaline ([48]), as we should expect. Anything, therefore, which raises the tonus of the sympathetic system will arrest gastric secretion more or less completely. Consequently this phenomenon is frequently present in cases of exophthalmic goitre, and the same remark applies to many forms of pyrexia in which failure of the digestive processes is a marked symptom. The presence of a hereditary, constitutional, inborn hypertonus of the sympathetic must also be recognised. In families in which this occurs several members may show diminution or absence of gastric juice ([49]) and not uncommonly this absence may be discovered even in early childhood.

Apart, however, from increase in the tonus of the sympathetic

or coincident therewith, it must be remembered that dominance of that system may result from enfeeblement or suppression of vagal stimuli. Atropine has this effect, but probably the best clinical example is to be found in the action on the para-sympathetic system of the toxines of the enteric group of fevers. In these there is a very striking diminution or even complete absence of gastric secretion, and this achylia is evidently due in large measure to interference with the vagal functions and consequent domination of sympathetic stimuli. If we were to limit our consideration to the gastric secretory functions alone, we should have difficulty in proving the truth of this statement, but fortunately the key to the problem is to be found in connection with the action on the heart of the toxines of these diseases—typhoid and para-typhoid—A and B. In such cases the cardiac contractions tend to be slow in rhythm. It might naturally be supposed that this slight degree of brady-cardia was due to increased vagal activity inhibiting and over-powering the acceleratory impulses of the sympathetic. Were that so, a dose of atropine would at once lower inhibition, as it does in a healthy man, and cause marked acceleration of the pulse rate. But, as Marris' careful observations (50) show, this is not the case, for in these diseases atropine is either without effect or if any quickening of the pulse does occur it is altogether insignificant in amount when compared to the normal response. The heart is, therefore, not being controlled by the vagus. Para-sympathetic stimuli are not reaching it or are doing so very imperfectly. Even pilocarpine no longer acts in such cases. Indeed there is evidence that the whole para-sympathetic system is depressed in typhoid cases, for not only is the inhibitory action on the heart removed, but other actions of atropine are interfered with, the dilatation of the pupil and the dryness of the throat which normally follow the administration of the drug being distinctly less than in health. All this is the more remarkable in that the action of adrenaline on the cardiac rhythm is preserved. It accelerates the heart as in normal persons, and if it does not raise the blood pressure, that, as well as the original bradycardia may be ascribed to the direct toxic action on the heart muscle which is recognised as occurring in typhoid fever.

The evidence of the action of these toxines on the para-sympathetic neurones is thus clear, and it may be safely assumed that the achylia found in cases of the typhoid group

owes its origin in great measure to diminution or loss of vagal stimuli. But, while this is so, it is reasonable to suppose that that absence of gastric juice is also in part due to direct toxic action on the secreting cells themselves, just as the circulatory phenomena are to some extent attributable to direct toxic action on the cardiac muscle.

Before proceeding to discuss the many other points which await our consideration, it may be useful to resume very briefly the various ways in which nervous impulses affect the act of gastric secretion, or, in short, the directions in which the balance between the two great autonomic systems may be disturbed, and the causation of these deviations from the normal equipoise.

A. *Conditions leading to Hyper-Secretion.*

Hypertonus of the vagus, which may be—

(1) Absolute, from hereditary causes; from abnormal reflex stimulation; from stimulation by toxines or para-sympathetic drugs, such as pilocarpine.

(2) Relative, the result of diminution of sympathetic stimuli from exhaustion, etc. The vagal stimuli will then preponderate unduly.

B. *Conditions leading to Diminution or Suppression of Secretion.*

Hypotonus of the vagus, which may be—

(1) Absolute, from toxic poisoning of para-sympathetic neurones as in typhoid fever, or from the paralysing action of such drugs as atropine, or even from pure exhaustion.

(2) Relative, from strong sympathetic stimulation, such as that produced by fear, or from the action of adrenaline and of certain drugs. Such strong sympathetic impulses inhibit and overpower vagal secretory stimuli, as is seen clinically in cases of Graves' disease.

But, whether the nervous stimuli influencing the secretion of gastric juice are acceleratory as under the heading A, or inhibitory as under B, the essential instrument on which they play and by means of which they act, is to be found in the secreting cells of the gastric wall. If the mucous membrane in which these cells lie, and of which they form the most important part, becomes involved in the course of some morbid

process, there must obviously be more or less disturbance of secretion, and this even if the nervous mechanism itself be intact. These pathological changes in the mucous membrane of the stomach vary very much in degree, showing, in some cases, it may be, merely a comparatively slight round-cell infiltration, in others almost complete destruction.

Suppression of gastric juice may therefore arise in different ways—from nervous causes or from purely local causes or from a combination of both of these. The achylia of gastric carcinoma is too well known as an important diagnostic symptom to require more than mention here. That of pernicious anæmia is also generally recognised. Alcohol taken in excess has a deleterious action on the gastric mucous membrane and its abuse leads in time to more or less pronounced achylia. Food which has been imperfectly chewed, or which is of an irritating quality, is apt to set up gastric catarrh which may lead to the same result. It is well known that during the later years of the Great War the German troops were supplied with very inferior rations. Böhme, who had wide opportunities of studying the gastric conditions of the men both on the Eastern and Western fronts, records ([51]) the high proportion of cases of achylia which he found, and which resulted from gastric catarrh due to irritating food.

But there are many other ways in which this local action on the mucous membrane of the stomach may be produced. Toxines of certain bacteria—tubercle bacilli and the like—swallowed with food and not destroyed by the hydrochloric acid of the gastric juice, may act in this way, and probably toxines of known and unknown micro-organisms, circulating in the blood, may seriously affect the secretory cells, just as they may affect the renal cells and cause nephritis. It is apparently in this way that intestinal toxæmia produces gastric symptoms, especially in cases of constipation.

From all this it must be evident that suppression of the digestive juices of the stomach can be no rare occurrence. The physician detects it frequently enough, but probably it is even more frequently overlooked, for in many such cases, symptoms, if present at all, are few and vague. Although achylia may result in so many different ways it may safely be said that the majority, probably the large majority of such cases, are due to nervous disorders of motility and of secretion, either directly or as complications or sequelæ.

Passing now to the more strictly clinical aspects of the subject, we may note in the first place the danger the physician runs of mistaking mere complications for the primary and underlying disease. Many examples of this might be given, but the two following will probably serve to illustrate and explain what is here meant. Let us suppose, in a given case, that the clinical signs and symptoms point to considerable gastric dilatation. Apart from organic disease (which we shall take to have been excluded) various questions as regards causation present themselves for consideration. The case may be one of hypertonus of the sympathetic. If this is so, the signs—distinct enough—will be those to be mentioned in detail presently.

But on the other hand the relaxation of the stomach wall may have a quite different origin. The case may have been originally one of vagal hypertonicity with gastric spasm. If this condition lasts long and with considerable severity, neuro-muscular exhaustion will probably follow, with consequent atonicity of the gastric wall and corresponding dilatation. An example of this has already been mentioned in connection with the later stages of congenital hypertrophic stenosis of the pylorus.

In these two instances, therefore, to make a diagnosis of "dilated stomach" would clearly be to take a very superficial and imperfect view of the case. In the second example more especially, the dilatation is merely one of the complications of the primary nervous disorder.

Let us now see whether we can think out the clinical conditions which should logically result from disturbed para-sympathetic innervation of the stomach. To do this with any hope of success, full use must be made of the physiological facts which have already been detailed.

In the first place we take for consideration the condition of hypertonus of the para-sympathetic, whether that tonus be absolutely above normal, or only relatively greater by reason of a lowering of sympathetic stimuli.

Results of Para-sympathetic Hypertonus.—We must here recognise that these results may be produced in various ways: —(1) From hereditary or other cause, often toxic in its origin, the whole para-sympathetic system may become hypertonic and dominant; (2) only certain efferent vagal neurones may be

affected in any particular case, the toxine or the reflex being selected, that is either the motor or the secretory neurones may be stimulated—more usually, however, both are involved; (3) the reflex may be local in its effects and confined to post-ganglionic neurones, either secretory or motor or both.

Stated shortly, the main results produced on the stomach by over-stimulation of the para-sympathetic are the following. The smooth gastric muscle is rendered hypertonic, and peristalsis is abnormally vigorous. The pyloric sphincter is more or

FIG. 5.—Facies of Para-sympathetic Hypertonus.

FIG. 6.—Facies of Sympathetic Hypertonus.

less relaxed. There is increased secretion of gastric juice. Let us see what effects these abnormal conditions are likely to have on the patient. What clinical picture will reveal itself to the examining physician?

Symptoms.—As an illustration let us take the case of a man (for in my experience this condition is much more common in men than in women), and a case in which the symptoms, though distinct, are only moderately severe. There are no complications, let us suppose, and the whole para-sympathetic is more or less involved. We may well be dealing here with a hereditary condition, the original and vital constitution of the individual.

Before making a complete examination, let us look at him as he sits there in the consulting-room. He gives the impression of health, perhaps of almost robust health. He is dark in complexion, his pupils are small and his skin may be thick, showing perhaps traces of acne. His features, especially the nose and lips, tend to be coarse, and from Fig. 5 some idea may be gathered as regards the type of facies present in many of these cases, though not by any means in all. As a contrast, the facies of sympathetic hypertonus is represented in Fig. 6.

Continuing our inspection, we may be able to conclude that the patient is a capable hard-working man with an active and acute brain. He is studious and probably sedentary in his mode of life. His manner is rather restless and his temper may tend to be short and quick. In more advanced cases there is often mental depression, sometimes to a marked extent.

His pulse-rate will be slow, and if we test his exercise-tolerance we shall find that the rate returns sharply to normal. His tongue is protruded actively and its musculature appears to be tense. He complains of dyspepsia, and, although there may be several related symptoms, he states that what chiefly troubles him is pain which he feels in the epigastrium and perhaps in the back as well. The important point now is to ascertain the exact time of incidence of that pain. The patient usually states that it occurs before a meal and that it is relieved by eating. We shall, however, be more correct if we regard it as coming on at a certain distance after a meal, for in truth it corresponds, in great measure at any rate, to the "hunger-pains" which Carlson has investigated so carefully and to which reference has already been made.

The interval which elapses between the meal and the onset of pain depends on the variety of food taken and on its quantity. The lighter the meal, the more rapidly does the stomach empty itself. It is then that the gastric spasms occur which give rise to the pain felt by the patient. These strong peristaltic contractions take place chiefly in the walls of the antrum. No vagal stimuli could possibly cause contraction of the pyloric sphincter. Their effect would tend to relax that muscular ring. Nevertheless it is probable that the pylorus does sometimes pass into strong and painful spasm from another cause. When a gush of acid stomach-contents enters the duodenum, it stimulates receptors there and a reflex closure

of the pyloric sphincter results. The greater the acidity the more vigorously will this closure take place, and thus at times pain may result from such pyloric spasm.

But this is not the true "hunger-pain" which we have been considering, the pain which is so typically relieved by eating. Why does it occur, by what mechanism is it brought about, and why does the taking of food remove it, at least temporarily? Its incidence is obviously determined by the length of time required to empty the stomach more or less completely, or rather the antral portion of that viscus where peristalsis is most marked. If the condition is one of emptiness, pain is felt: if the antrum is filled, that pain ceases. It looks as if "hunger-pain" of this kind resulted from the tension and squeezing together of the antral walls, and that it no longer took place when these walls were separated, during the passage of strong peristaltic waves, by a layer of soft food.

In the case of a man who takes his chief meal—be it dinner or supper—at a late hour, say at eight o'clock, the pain will awaken him about two, three, or four in the early morning. This may be considered as the usual interval in the case of a copious meal. But there are considerable variations, for the pain-free interval may be longer or shorter in duration in different cases and even in the same case at different times. It is to be remembered that increased vagal stimulation not only causes hypertonus of the gastric wall but also tends to relax the pyloric sphincter. Thus the stomach may empty with considerable rapidity, as in the case already mentioned on page 171, and the interval may be correspondingly short. Various structural changes at the pylorus would tend to have an opposite effect.

But, though pain is his chief complaint, our patient makes mention of sundry other symptoms which complete this part of the clinical picture. He probably suffers from heartburn, possibly from some palpitation, from flatulence, from acid eructations, and from a sudden flow of saliva into the mouth. The meaning and mode of origin of these symptoms will receive notice presently.

His appetite is good, almost too good, and on being questioned he will confess that he does not chew his food carefully or sufficiently. If he lives alone, he will take his meals with unreasonable rapidity, for the activity of his brain will make him feel that any lingering at table is mere waste of

time. If the walls of the stomach are in high tonus, he will probably have a feeling of fullness after eating.

Such a clinical picture presented by the symptoms enumerated above will at once suggest that the vagal stimuli are abnormally powerful in this man and that the motility of the stomach and probably its secretory activities have been correspondingly influenced. The correctness of this assumption can be proved only by an extended and minute examination of the patient. Only thus can we hope to reach some definite conclusion as regards the cause of the para-sympathetic hypertonus which is evidently present. To this examination we now proceed.

In a case so comparatively early, palpation of the abdomen may not help us much, though perhaps it may reveal some epigastric hyperæsthesia. If, however, the spasm of the antrum is very marked and if the abdominal walls are thin, we may be able to feel some resistance there, almost like that of a tumour, when the spasm is at its height.

In so far as percussion or auscultatory percussion is capable of yielding information, its results will indicate that the stomach is small in size, or at any rate that it is not dilated. We are dealing, it will be remembered, with a comparatively early and uncomplicated case.

To ascertain correctly, however, the size, position, and motility of the stomach, X-ray methods must be employed. For this purpose it is usual to give four ounces of carbonate of bismuth or of sulphate of barium, either in water or in bread and milk, suitably sweetened. The physician should not trust entirely to photographs, but should himself carefully study the shadow on the screen, and he should do this not only while the patient is in an upright position but also when he is lying on the couch. The angle of incidence of the rays should be varied, and some simultaneous palpation of the abdomen is usually required. The jet of bismuth falling through the œsophagus and cardia into the stomach can be easily seen, and this may give information as regards the momentary condition of the cardiac sphincter. After the meal has been completely swallowed, the greater curvature of the normal stomach reaches a level a little below that of the umbilicus.

If the conditions are normal, the stomach should empty itself in about three hours. After five or six hours the bismuth should be in the cæcum and ascending colon. In such a case

as the one we have been considering, these times will be shorter, perhaps much shorter. In him the stomach will be hypertonic, the border of the greater curvature above the umbilicus, the gas-bubble small in size and the outline of the stomach narrowing gradually towards the pylorus. The peristalsis would be active and powerful, especially at the inciscura and in the antrum.

It has been pointed out (see p. 168) that gastric spasm of this kind is often produced by reflex action from some local irritation. Indeed, such signs and symptoms as have been described are not infrequently the result of duodenal ulcer, and it should be remembered that where there is vagal hypertonus, very slight irritation is calculated to produce marked effects. It is therefore of the utmost importance that the presence of such a condition should be definitely excluded. On the screen, and particularly on the photographs, the most careful search should be made for any pockets containing bismuth in the duodenal wall, indicating the presence of such an ulcer. The detection of occult blood in the stools might also suggest that duodenal ulceration was present. The test, a simple one if due precautions are taken, is usually made by the benzidene method. But there are of course other possible causes, such as carcinoma or gastric ulcer, which might give rise to a possible reaction. Though the symptoms we have been considering do not suggest the presence of a gastric ulcer, yet in making the X-ray examination the physician would naturally try to satisfy himself that no such condition could be detected, that no bismuth-containing pocket showed itself as projecting from the stomach wall.

So far we have been dealing with the motor activities of the stomach under the influence of a hypertonic condition of the para-sympathetic system. The next line of inquiry must have regard to the secretory effects of that state. For this purpose an analysis must be made of the stomach contents after a "test-meal." What we have to find out is the amount of physiologically active hydrochloric acid present, that is the free plus the organically combined acid.

On p. 182 it was pointed out that this acidity in the case of pure gastric juice was fairly constant at 0·5 per cent. and that this figure was distinctly higher than that ever found clinically in the gastric contents after a "test-meal." The reason of this is that a certain amount of dilution and of neutralisation takes

place owing to admixture with saliva and mucus and with duodenal contents which have passed back into the stomach. But if the percentage of hydrochloric acid in the stomach contents, under normal or abnormal conditions, never reaches that of pure gastric juice, it is obvious that the term "hyperchlorhydria" is not strictly correct. What has really happened in such cases as those which sometimes go by that name is that an increased secretion of juice has taken place. There is, therefore, more HCl present requiring neutralisation. Hence the acidity of the gastric contents rises above normal.

Practically, when the gastric contents have been removed by the stomach tube an hour after a "test-meal" of tea and toast, the acidity in normal persons is about 0·2 per cent. But in the case we are considering, we should probably find it to reach 0·3 per cent. or even 0·35 per cent. In him not only the motor, but also the secretory neurones of the vagus, are in a state of over-stimulation. Thus we find the stomach hypertonic with strong peristalsis, and we detect signs of hyper-secretion of gastric juice.

Let us now consider the causation of certain of the other symptoms of which these patients complain. Salivation has already been mentioned. The rush of this secretion into the mouth occurs at the height of the gastric pain, and its amount is often so considerable that the patient is unable to swallow it completely. The alkalinity of the secretion, moderate under normal conditions, is now much increased, and the proportion which passes into the stomach serves to neutralise the gastric contents to some considerable extent. So much is this the case that with the passage downwards of the saliva the gastric symptoms usually cease.

Sometimes this salivation occurs when little or no gastric pain is being experienced. The following case which I had the opportunity of observing carefully illustrates this point. The patient was a man of studious and rather sedentary habits who from time to time suffered from the classical symptoms of that form of dyspepsia we are now considering. The gastric pain in his case sometimes occurred during the day, but much more usually it attacked him in the early hours of the morning. Its severity was such as to waken him instantly and completely. This state of matters would go on night after night he told me, for some weeks during which he suffered from that mental depression which insomnia is fitted to produce. Fortunately,

however, in this man's case there were intervals possibly lasting for many weeks in which he was free from pain and his nights peaceful. But the history he gave me brought out the curious fact that though his sleep remained unbroken during these intervals, yet on waking in the morning he frequently found saliva flowing freely from his mouth, and this to such an extent that the pillow on which his head had rested was soaked with that secretion. In this case, then, para-sympathetic hypertonus, probably always present, varied much in degree, the stimulus being sometimes strong enough to cause painful gastric spasm, at other times weaker so that the only evident symptom was salivation.

The causes of the flatulence which so often occurs in such cases are various. Apart from cases of actual air-swallowing in neurotic subjects, the stomach may be distended by reason of the air which, as is well known, is constantly being swallowed along with food. Moreover, the saliva, as it passes downwards, contains many bubbles of air. Of greater importance, however, is the gastric distension due to over-formation of carbonic-acid gas. This depends in great measure on the composition of the saliva, which in such cases is abnormally alkaline. Its alkalinity is mainly due to the presence of carbonates of sodium and of calcium. When these carbonates meet the hydrochloric acid in the stomach, much CO_2 is evolved. But besides these inorganic salts, the saliva contains in solution a considerable amount of CO_2. It is probable also that the occasional passage backwards of the alkaline duodenal contents is in part responsible for the production of that gas in the stomach. Except in cases of marked pyloric obstruction, fermentation of the gastric contents need not be regarded as a cause of flatulence.

This flatulent distention of the stomach, especially of the fundus, is apt to produce mechanically an effect on the cardiac rhythm, and the palpitation from which such patients suffer at times is occasioned, in some measure, by the pressure of the distended viscus on the diaphragm. But it must be remembered that cardiac irregularity may be, and often is, produced in such cases by reflex vagal stimulation.

Diagnosis.—When we turn to consider the diagnosis of this sthenic dyspepsia (so often called "hyperchlorhydria"), we shall find that a considered opinion must ultimately rest on four sets of data:—

1. The clinical picture formed by the symptoms of which the patient complains.
2. The condition of the stomach—its size, position, and motility—as revealed by X-ray examination.
3. The analysis of the gastric contents, particularly as regards their degree of acidity.
4. The results of treatment.

Having arrived thus at a correct diagnosis, it is of some importance to proceed a step further and to ascertain, if we can, whether the vagal hypertonicity is confined to gastric neurones, or whether the whole para-sympathetic system is involved. The latter will certainly be the case if the condition is hereditary: it may be the case in instances arising otherwise.

What signs might suggest to us that the para-sympathetic system generally is in a state of heightened tonus? The small pupils might indicate that stimuli passing by para-sympathetic neurones were overpowering those of the sympathetic. The same remark would apply to salivation, for the neurones of the chorda tympani belong to this division of the autonomic system as also do those running in the zygomatic nerve. The production of cardiac irregularity has already been referred to. Another symptom not previously mentioned is undoubtedly para-sympathetic in its origin. I refer to the attacks of asthma which some of these patients experience in association with pain in the early morning. The bronchial constriction is certainly para-sympathetic in causation.

Stating the matter thus, it seems as if one were linking together a chain of circumstantial evidence, not entirely convincing or conclusive, but fortunately the case may be completely proved, and the truth brought out clearly, if we care to use definite tests. We may, for example, make use of the oculo-cardiac reflex. It is one to which a considerable amount of attention has recently been directed ([52]). If, in a healthy man, the eyeball be compressed with some degree of firmness for about thirty seconds, the rate of the pulse falls by ten to twenty beats per minute. This reflex is abolished by atropine, the efferent fibres being vagal. If the para-sympathetic tonus is high the effect of compression on the pulse rate is much greater and may even go the length of complete inhibition. Unfortunately, the amount of compression required to elicit this reflex causes the patient considerable discomfort,

if not actual pain. It is, however, a valuable guide wherewith to measure para-sympathetic tonus, for if that tonus is low, either absolutely or relatively, there will be no fall of pulse rate, indeed acceleration and not retardation may result.

Another means of estimating para-sympathetic tonus—also in connection with the innervation of the heart—is to be found in the degree of exercise-tolerance present in the case. If the vagal tonus is high, the pulse after exercise will be found to return to its normal rate with unusual speed.

We may use yet another test if we observe the effect of respiration on the cardiac rhythm. The alveoli of the lungs are plentifully supplied with afferent para-sympathetic fibres, which, stimulated by pulmonary expansion and relaxation, conduct impulses to the medullary centres. As a result, reflex stimuli pass down the vagus with each phase of respiration and these can be registered by means of the string-galvanometer. Their effect on the rate of the heart can also be detected clinically in those persons in whom the vagal tonus is high. In experimental physiology it has long been known that stimulation of the afferent neurones from the alveoli of the lungs causes marked inhibition of the heart. The investigations of Brodie and Russell ([53]) bring this out clearly. By the bedside, an increase of pulse rate during inspiration and a decrease during expiration can often be observed readily enough. This respiratory irregularity is common, indeed physiological, in young persons, and merely indicates that the vagal tone is good. In adults, however, at least of the age of forty or over, any marked irregularity of this sort indicates abnormal tonicity of the vagus, either absolute or relative to that of the sympathetic neurones. If, in a case of this kind, a deep inspiration be taken and maintained, during its maintenance the pulse may become very slow and very feeble, the inhibitory effect being considerable. That this is due to a vagal reflex is clear, for a dose of atropine prevents its occurrence, the drug paralysing the myo-neural junction of the para-sympathetic fibres.

The absence of glycosuria after the administration of adrenaline or after the consumption of glucose may also be regarded as an indication of hypertonicity of the para-sympathetic system. And certainly any marked sensitiveness to pilocarpine is a valuable indication of para-sympathetic hypertonus. Considerable salivation after a hypodermic

injection of $\frac{1}{10}$ grain would be such an indication. Unusual tolerance of fats in the diet points in the same direction.

We have therefore in these tests a means of determinating with fair accuracy the degree of para-sympathetic tonicity in any given case. We can thus decide whether the abnormal gastric innervation is or is not a part of a general condition affecting the whole of the great para-sympathetic division, in so far, at any rate, as the mid-brain and the medullary outflow are concerned.

Before considering the lines of treatment which should be adopted in a case of this kind, a few words may be said as regards certain complications likely to occur when the patient has suffered long and with considerable severity.

After years during which the smooth muscle of the gastric wall has been more or less constantly under the strain necessarily produced by hypertonicity, that smooth muscle with its neural mechanism becomes overtaxed and exhausted. There then inevitably follows a greater or lesser degree of atonicity and consequent dilatation. The clinical aspects of the case then become altered, especially if gastric ptosis follows, as is often the case. We then have a previous history of such symptoms as have already been described—a history, it may be, of many years' duration. These symptoms have now changed in certain particulars. The tongue has become flabby and furred, the appetite, previously quite good, fails in a marked degree, and the patient has frequent attacks of nausea and of vomiting. Constipation also is usually a prominent symptom. As may be imagined, metabolism in such a case is seriously disturbed and the patient emaciates, sometimes to an extreme degree. If this state of matters continues and increases, signs of toxæmia appear, the result of bacterial action in the greatly dilated stomach, and a fatal result follows. Though much more gradual in their onset and more prolonged in their course, these symptoms closely resemble those seen in a fatal case of hypertrophic stenosis of the pylorus as already described. In children suffering from this disease and not efficiently treated, the violent gastric spasm exhausts the smooth muscle of the stomach wall, dilatation follows with toxæmia and death.

The physical signs in advanced cases such as we are now considering are profoundly changed, as are the symptoms. The contour of the abdomen shows the altered position of the

stomach, as does the area marked out by percussion. Splashing is easy to elicit. A series of X-ray photographs gives certain evidence of the increased size and altered position of the viscus, and on the screen, the diminution or absence of motility becomes apparent. No longer can the stomach empty itself in normal time, indeed it never does empty to any effect except by vomiting. If this does not occur and lavage is not made use of, some particular article of food may remain in the gastric cavity for days, weeks, or even months.

But probably for some years before the stage is reached during which these extreme symptoms manifest themselves, the stomach wall is gradually relaxing and its contents are not being passed onwards with due speed. Decomposition is therefore occurring, toxines are being formed and are producing irritating effects on the gastric mucosa. Hence arises gastric catarrh, so frequently a complication in such cases and one fitted of itself to weaken the wall of the stomach. And yet another cause of stretching is to be found in the weight of the retained gastric contents, maintaining constantly an abnormal pressure and making for yet further dilatation.

A minor cause of dilatation but one probably of frequent occurrence is to be found in the degree of pyloric spasm, produced by the irritation of hard masses of unmasticated food as they reach that sphincter. Cannon found that when hardened pellets of bismuth, passing through the antrum, came in contact with the pylorus, that passage automatically closed to prevent their progress and they were thrown back into the stomach.

It is not necessary to allude here to the results of organic stricture of the pylorus and to the marked dilatation of the stomach which follows such obstruction. For these, the services of the surgeon are usually required.

Treatment.—Conditions of vagal hypertonus such as have been described frequently occur in persons otherwise healthy and do not necessarily, or even generally, pass on to the very serious later complications which lead to toxæmia and to death. Such a state of matters is fortunately rare when we consider how large is the number of persons in whom the disease exists. It can hardly occur except in cases in which treatment has been carried out on wrong lines or entirely inefficiently. Parasympathetic hypertonicity does not, of itself, lead to death.

On the other hand, it must be admitted that such cases

of vagal hypertonicity as we have been considering are hardly capable of permanent or complete cure. But while this is so, they are capable of relief, and if the means of relief are applied with care, patience, and continuity, a condition nearly approximating to cure may be attained. Moreover, as age advances, the para-sympathetic hypertonicity quiets down with distinct amelioration of the symptoms. The intensity of these symptoms is greatest in middle age when the vital processes are at their maximum. Later, the tonus of the para-sympathetic gradually diminishes and consequently the symptoms become less urgent. A similar diminution is seen, it will be remembered, in connection with asthma, hay-fever, migraine, etc.

But not only do the activities of the neurones concerned lessen in the later years of life, but circumstances occasionally occur under which a sudden, though quite temporary, exhaustion of the vagal centres takes place. Thus, in such a case as we have been considering, a very violent attack of vomiting may be followed by a quiescence of gastric spasm lasting for a day or even for a couple of days. During this period of intermission the patient may be able to take food normally and to digest without any trace of discomfort. This may be considered as strictly analogous to the exhaustion of the neurones of the pyramidal tracts which follows a severe epileptic convulsion, revealing itself to us by the very transient appearance of Babinski's reaction. The more permanent exhaustion of motor vagal neurones and of the smooth muscle of the stomach wall, seen in late cases with gastric atony and dilatation, has been referred to already.

In treating an ordinary case, our object is to depress both the motor and the secretory activities of the vagus and thus to control excessive peristalsis and to diminish the amount of hydrochloric acid which is being secreted by the gastric mucosa. As a rule, we cannot influence either of these sets of neurones separately, for the remedies which depress the one have a similar effect on the other.

If, on the other hand, a later stage has unfortunately been reached in which there is gastric dilatation, a totally different line of treatment is required, for then our main object should be to restore the motor activity of the stomach wall and to prevent the onset of toxæmia.

Considering, then, the treatment to be adopted at a

moderately severe stage of the malady, beyond which it is to be remembered our patient may and should never pass, the following methods either alone or combined are those best suited for our purpose, namely, to depress the hypertonicity of the vagus until its neurones approximate to a normal level of excitability. But, as a preliminary measure in all cases, it is to be remembered that the most careful attention should be paid to the state of the bowels. Constipation undoubtedly increases the severity of the symptoms and must be avoided. Laxatives should be administered as required, and it is usually advisable to give a dose of calomel or other mercurial purgative at intervals of a week or ten days.

1. *Inhibition of the Vagus.*—It is clear from what has been said already that stimulation of the sympathetic system tends to produce inhibition of the para-sympathetic. If then we can raise the sympathetic tonus, we shall in that way lower the hypertonus of the vagus and so diminish the strength of the gastric peristalsis and the amount of the gastric secretion. This is indeed Nature's way of meeting the difficulties we are considering, and if only we could produce a lasting and considerable increase of sympathetic tonus, all our difficulties would disappear. The balance, so markedly upset in one direction in the cases we are considering, would thus be restored to its normal equilibrium and the abnormal vagal symptoms would cease.

Not only is this Nature's way, but it is the only way whereby we can hope to produce a radical change in the disturbed nervous mechanism without the employment of drugs of a more or less potent kind. Unfortunately from a practical point of view the desired result is difficult of attainment. The difficulty consists in this, that while in many cases it is easy enough to produce sympathetic stimulation, it is difficult to cause that stimulation to be more or less continuous and not merely temporary.

There is nothing which excites the sympathetic so naturally and so effectively as certain forms of emotion, and in doing so inhibits the para-sympathetic. For example, take what frequently occurred in the case of the father of a professional friend of mine, who suffered from severe and prolonged attacks of asthma. A faithful and devoted clergyman, he was so intent on the due performance of his clerical duties that he frequently left his sick-bed to conduct the service in his church. Severely

dyspnœic, he had to be helped, almost carried, up the stairs of the pulpit. But the moment he began to preach, the excitement this involved so stimulated his sympathetic system that the vagus was inhibited and the bronchial spasm relaxed. All trace of asthma then disappeared and his voice came clear and strong. His emotion had, for the time at least, restored the normal equipoise.

We cannot produce at will this very salutary emotional disturbance in our patient, at any rate in so marked a degree, but we can go some way towards it by advising him to avoid depressing surroundings and to cultivate whatever makes for cheerfulness. For this reason he should not take his meals alone, as he is too apt to do. On the contrary, he should dine as often as possible at a table where the atmosphere is that of a happy geniality and where the talk is lively, interesting, and inspiring. After such a meal he is much less likely to suffer from gastric pain than he would be were he to dine in solitude and depression. He requires a mental stimulus.

Of no lesser importance is muscular exercise, taken to the extent of reasonable fatigue. From the results of many researches ([54]) we know, on the one hand, that muscular weakness results from adrenal insufficiency, and on the other that fatigue stimulates the suprarenal glands and increases the supply of adrenaline. The patient should therefore be encouraged to take regular exercise in the open air, and that exercise will be the more stimulating and therefore the more helpful if it is such as involves keen interest. Games are therefore best, and in many cases golf is the most suitable. In these various ways the tonus of the sympathetic may be increased and the hypertonus of the vagus correspondingly diminished. Small doses of thyroid extract, acting as a stimulant to the sympathetic system, may be of distinct benefit in these cases. Although such measures are always salutary and should always be advised, we must not expect them to produce any very striking improvement except in early and comparatively slight cases where something approaching cure may be attained. In most instances, more decisive and definite treatment is necessary if we are to relieve the sufferings of our patient and prevent the further progress of the malady. We have therefore to betake ourselves to drugs, choosing such as may serve to lower the vagal tone and restore the normal equilibrium, and to use them in such doses as shall effect that

purpose without unduly interfering with the other bodily functions.

2. *Lowering the Vagal Tonus by Means of Drugs.*—The simplest way in which the hypertonicity of the vagus can be reduced is by means of the bromides. The action of these salts is probably central, and just as by their means the palatal reflex may be abolished, so may the strong peristalsis of the stomach be weakened and the spasm relaxed. Small doses continued over long periods are often of great service. It must also be remembered that when the potassium salt is administered in this way, the chlorides in the tissues are diminished and the hydrochloric acid of the stomach is to some extent replaced by hydrobromic acid.

Of greater importance, however, is the paralysing effect on the neurones of the vagus produced by belladonna and atropine. This action takes place at the neuro-muscular junction and on the nerve-endings in connection with the oxyntic cells of the mucosa. Impulses passing down the vagal neurones, both motor and secretory, are thus blocked, the stomach walls relaxed and the gastric secretion diminished or suppressed. The effect of a dose of atropine on the smooth muscle of the stomach is shown in Fig. 2, p. 176. It is of course not necessary and certainly not desirable to give doses so large as to block all efferent vagal impulses. Our object in such cases is but to moderate the intensity of the stimulation which is reaching the stomach. It is therefore best to use the tincture of belladonna and not atropine itself. In giving belladonna, however, the practitioner should remember that some persons have marked idiosyncrasies in regard to the drug, though my experience suggests that these peculiar reactions are not likely to occur in cases of hypertonus of the para-sympathetic system.

It will be found that a dose of five to ten minims of the tincture of belladonna, given before food, usually produces the desired effect. Its combination with alkalies will be referred to later. In some cases, however, considerably larger doses are required, especially if the object is to relieve reflex gastric spasm set up by irritation in neighbouring organs, such as the gall-bladder. But, when used in cases of sthenic dyspepsia such as we are considering, the action of belladonna has one great disadvantage. Not only does it limit gastric secretion but also it suppresses the outpouring of saliva. Stress has already been laid on the great importance of the presence in

the stomach of this alkaline secretion and more must be said on the subject presently. It seems highly probable that in those cases in which the administration of belladonna does not produce the desired effect, the failure is thus to be explained.

If the afferent reflex causing gastric spasm originates in the mucosa, the irritability of the receptors there may be soothed by giving dilute hydrocyanic acid, or by means of menthol. I have found validol a useful preparation of the kind. Bismuth subnitrate is much used for this purpose, but I have not been able to convince myself that it possesses any distinct or considerable value.

Curiously enough, experiment has shown that bicarbonate of soda, given before a meal, limits the production of gastric juice. Clinical evidence confirms this and in many cases much relief is obtained by swallowing, half an hour before a meal, a large tumbler of hot water in which that salt has been dissolved. In this way the stomach may be cleansed, mucus lingering there swept away and over-secretion of gastric juice controlled. Some patients find it better to take the alkali in effervescing water, and the absorption is certainly more rapid then. Sometimes it is convenient to give the bicarbonate in a cachet. In that case I am in the habit of adding a few grains of ichthalbin and of salacetol. The cachet should be followed by a draught of hot water—a pint or even more. This combination has the advantage of producing a certain amount of antiseptic action.

A similar inhibitory effect on gastric secretion is produced by oils and fat. Many patients find that a tablespoonful of pure almond or olive oil, taken before a meal, gives great relief. I learned this many years ago from a gentleman who had discovered its advantages in his own person.

We may control the over-production of hydrochloric acid in yet another way, for, if we place the patient on a "salt-free diet" the chloride necessary for the production of the acid is in great measure restricted. It is of course impossible to eliminate salt entirely from the food the patient takes, nor would it be desirable to do so. But salt should be used very sparingly at table and certainly the dietary should not include any salted food.

3. *Neutralisation of the Gastric Contents.*—It has already been pointed out (see p. 182) that the means Nature adopts for the neutralisation of over-acid gastric contents are mainly

three:—admixture and dilution with (1) alkaline saliva, (2) alkaline mucus, (3) the regurgitated alkaline contents of the duodenum. I know of no way whereby we can influence the third of these, unless the relief which follows light massage or tapping with the fingers over the region of the pylorus is thus to be explained. But we can do a good deal to augment the first and to some slight extent the second of these methods.

The importance of a proper, even an excessive, flow of saliva in such cases as we are considering can hardly be over-estimated. This depends not merely on the potency of its enzyme as enabling the patient to digest usefully a certain amount of starch-containing food, but also on its alkalinity and the partial neutralisation of the stomach contents which thereby results.

The easiest way of exciting a flow of saliva is by using the stimulus of strong flavours in the mouth. But this method must be avoided at all costs for the taste of such things as spices and condiments excites the very reflex we are so anxious to moderate, causing as it does more vigorous peristalsis and an increased flow of gastric juice. Nature's way of stimulating saliva, which ought to be ours, is by the act of chewing. Due complete and thorough mastication is of supreme importance, and therefore one of the first things demanding the attention of the physician is the condition of the teeth of his patient.

The value of thorough chewing is sometimes learned by the sufferer himself. A few weeks ago I was consulted by a gentleman of acute intelligence whose symptoms were those of vagal hypertonus. When I spoke to him of the necessity of carefully chewing his food, he interjected quickly, "But I've found that out for myself. I keep the stuff in my mouth ever so long. Indeed," he added, "it's a disgusting habit, but it pays."

Very simple things, when sucked in the mouth, sometimes effect our purpose. An almost tasteless gum or glycerine lozenge will cause a flow of saliva, and a lady who consults me at times finds that a liquorice lozenge suffices to relieve her symptoms. I know a man who sucks a pebble for the same purpose. In all these methods, we are endeavouring to imitate Nature's processes, but, at all events, in cases of any considerable severity, we have to go further and to ensure the necessary degree of neutralisation by giving alkalies of one kind or another.

Note on Sthenic Dyspepsia

We have at our command a long list of antacid remedies—preparations of ammonia, the bicarbonates of sodium and of potassium, carbonate of calcium and of magnesium, and many others. Although the bicarbonate of sodium is probably the most frequently used of these, it has, as have the other bicarbonates, the theoretical disadvantages of causing the evolution of CO_2 in the stomach. Certainly, in cases in which there is much flatulent distention of the viscus, this disadvantage is more than merely theoretical. Yet, in ordinary cases, I believe that one or other of these salts is on the whole the best remedy to choose. The evolution of CO_2 stimulates the mucosa to pour out alkaline mucus and this is of itself a help in such cases. If, however, we have strong reason to avoid such evolution, we may use some preparation of magnesia other than the carbonate. The cremor magnesiæ fulfils the purpose, neutralising the hydrochloric acid and yet giving rise to no CO_2 and consequently to no gastric distention.

The late Sir William Roberts[55] pointed out the great advantage there is in giving antacid remedies in the form of lozenges, for these, if they are sucked, lead to that beneficial outpouring of saliva which is of itself so important. But, whether we give the chosen alkali in the form of a lozenge or whether we give it dissolved in water or in aerated water, care must be taken to select the proper time for its administration. This should be just when the "hunger-pain" shows signs of starting, that is some hours after a meal, the exact time depending mainly on whether the meal has been copious or not. The relief should be great if the proper salt has been selected, but it must be borne in mind that patients vary in this matter, some doing best on soda, others on magnesia.

It is often of great service to give belladonna along with the alkali when pain threatens, instead of administering it before the meal. Sometimes the one plan suits best, sometimes the other, and the physician must be guided in this matter by his observation of the individual case with which he is dealing. In ordering the mixture, which is to contain tincture of belladonna and bicarbonate of soda, care should be taken that no strong flavouring agent is added as that may excite gastric spasm and increased secretion of gastric juice.

4. *Diet.*—Several points of importance as regards diet have already received notice. Mastication of each mouthful should be performed thoroughly and slowly so that the food may be

finally divided and well mixed with saliva before it reaches the stomach. Unless the teeth are sound and efficient, this aim cannot be reached. If lumps of meat are swallowed whole they will be liable to cause pyloric spasm in the manner mentioned on p. 200. The use of fat as an agent in inhibiting gastric secretion, and the advantages of a "salt-free" diet, have been mentioned above.

To some extent the experience of the patient ought to prove a useful guide. If he is a sensible person he will know what agrees with him and what does not agree. The old saying, attributed, probably correctly, to the Emperor Tiberius, will occur to the reader: "Every man at forty is a fool or a physician." But the patient may not be a sensible man, and even if he is he may not possess enough of that self-control necessary to deny himself those dishes which, though pleasing to his palate, are in reality harmful. I remember the reply I once got from a peppery old Indian general when I was advising him not to eat a curry of which he was inordinately fond. "Sir," he exclaimed, glaring at me out of lightly blood-shot eyes, "sir, I will not be bullied by my stomach."

On the other hand it is possible for the patient to be too careful as regards food. A good many years ago a lady of thirty-two was sent to me in a state of great emaciation. She came from the South and had suffered many things of many physicians, having been instructed never to eat anything which had even once given her pain. The accurate carrying out of this advice had resulted in her diet being composed exclusively of a little skimmed milk. Of medium height, her weight was then but a pound or two over five stone. I placed her in a nursing home, had her carefully fed and massaged, and controlled her gastric pain by means of alkalies and belladonna. In ten weeks she weighed over eight stone. She allowed herself to be photographed, both before and after treatment, and these photographs are reproduced in Figure 7.

When we come to practical details in arranging a suitable diet for a patient suffering from vagal hypertonicity (sthenic dyspepsia), we have to divide mentally all possible foods into two classes—(1) those which stimulate gastric motility and secretion, and are, therefore, to be avoided, and (2) those which do not act in this way, some even inhibiting peristalsis and secretion. Clearly it must be in this latter class that we are to find food likely to suit our patient.

We must exclude from the diet such excitants as meat extracts, all pickles, spices, and condiments, all acid dishes, and all tough meat which cannot be sufficiently broken up in chewing. As a rule the patient should take little sugar. Sweet wines are to be avoided, indeed he will probably be wise to take no alcohol in any form.

The diet should include plenty of fat, and the easier the fat liquefies the better for the patient. That of bacon fulfils this indication. Cream and fresh butter should be used freely, and milk if taken alone (between meals, for example) usually agrees admirably. Eggs (not hard-boiled), white fish, and chicken are suitable. As regards red meat, if the patient

FIG. 7.

cannot chew well, it should be finely minced before reaching the table. Of vegetables—spinach, cauliflower, and vegetable marrow may be recommended. Potatoes, if used at all, must be carefully cooked, preferably by steaming. The bread the patient takes should never be new. The drier it is the more mastication it requires and in consequence the greater is the flow of saliva.

Such, in brief outline, are the general rules by which the diet of patients suffering from the effects of hypertonus of the vagus should be regulated. But it must be remembered that individuals differ materially as regards the digestion of food-stuffs, and the wise physician should be guided by observation of the particular patient with whom he is dealing.

If gastric dilatation or gastroptosis has occurred, the treatment must be altered to a material extent, and the writer hopes to deal with this aspect of the disease in a later article.

BIBLIOGRAPHY.

[1] Rosenbach, O., "Nervöse Zustände und ihre psychische Behandlung," 2te Aufl., Berlin, 1903.

[2] Cannon, W. B., "The Mechanical Factors of Digestion" (Intern. Med. Monographs), London, 1911.

[3] Kastle, C., Rieder, H., and Rosenthal, J., "Ueber kinematographisch aufgenommene Röntgenogramme (Bio-Röntgenographie) der inneren Organe des Menschen," *Muench. med. Woch.*, 1909, lvi. 280.

[4] Scheunert, A., and Kiok, F., "Zum Mechanismus der Magenverdauung beim Omnivoren," *Pflüger's Archiv*, 1922, cxciii. 16.

[5] Grutzner, P., "Ein Beitrag zum Mechanismus der Magenverdauung," *Pflüger's Archiv*, 1905, cvi. 463.

[6] Sherrington, C. S., "Postural Activity of Muscle and Nerve," *Brain*, 1915, xxxviii. 191.

[7] Langley, J. N., "Connexions of the Enteric Nerve Cells," *Journal of Physiol.*, 1922, lvi., *Proc. Physiol. Soc.*, xxxix.

[8] Meiklejohn, S. J., "On the Development of the Plexiform Nerve Mechanism of the Alimentary Canal," *Journal of Physiol.*, 1908, xxxvi. 400.

[9] Klee, Ph., "Der Einfluss der Vagusreizung auf den Ablauf der Verdauungsbewegungen," *Pflüger's Archiv*, 1912, cxlv. 557.

[10] Miller, F. R., "On Gastric Sensation," *Journal of Physiol.*, 1910-11, xli. 409.

[11] Elliot, T. R., "The Action of Adrenaline," *Journal of Physiol.*, 1905, xxxii. 401.

[12] Keith, A., "On the Interpretation of certain X-ray Signs of Intestinal Stasis," *Proc. Roy. Soc. Med. London*, 1915-16, ix. Electr., 1.

[13] Cannon, W. B., and Washburn, A. L., "An Explanation of Hunger," *Amer. Journal of Physiol.*, 1911-12, xxix. 441.

[14] Carlson, A. J., "The Character of the Movements of the Empty Stomach in Man," *Amer. Journal of Physiol.*, 1912-13, xxxi. 151.

[15] Carlson, A. J., The Hunger Contractions of the Empty Stomach during Prolonged Starvation," *Amer. Journal of Physiol.*, 1914, xxxiii. 95.

[16] Carlson, A. J., "The Control of Hunger in Health and Disease," Chicago, 1916.

[17] Lewandowsky, M., "Die Funktionen des zentralen Nervensystems," Jena, 1907.

[18] Goltz, F., "Der Hund ohne Grosshirn," *Pflüger's Archiv*, 1892, li. 570.

[19] Carman, R. D., "Spasm of the Stomach and Duodenum from a Roentgenologic Point of View," *Collected Papers of the Mayo Clinic*, 1916, viii. 102.

[20] Mann, F. C., "A Further Study of the Gastric Ulcers following Adrenalectomy," *Collected Papers of the Mayo Clinic*, 1916, viii. 124.

[21] Gundelfinger, E., "Klinische und experimentelle Untersuchungen über den Einfluss des Nervensystems bei der Entstehung des runden Magengeschwürs," *Mitteil. a. d. Grenzgeb. d. Med. u. Chir.*, 1918, xxx. 189.

[22] Elliot, T. R., "The Experimental Formation of Acute Gastric Ulcers," *Quart. Journ. of Med.*, 1914, vii. 119.

[23] Katayama, K., "Pathologisch-anatomische und experimentelle Studien über das Magengeschwür," *Mitteil. a. d. med. Fakultät d. k. Univ. zu Tokio*, 1920, xxiii. 235.

[24] Magnus, R., "Die stopfende Wirkung des Morphins," *Pflüger's Archiv*, 1906, cxvi. 316; 1908, cxxii. 210.

[25] Smidt, H., "Röntgenologische Untersuchungen über das Verhalten des Magens während des Gallensteinanfalls," *Archiv f. klin. Chir.*, 1921, cxvii. 425.

[26] Miller, F. R., "On Gastric Sensation," *Journal of Physiol.*, 1910-11, xli. 409.

[27] Kelling, G., "Ueber den Mechanismus der acuten Magendilatation," *Archiv f. klin. Chir.*, 1901, lxiv. 393.

[28] Cannon, W. B, "The Motor Activities of the Stomach and Small Intestine after Splanchnic and Vagus Section," *Amer. Journ. of Physiol.*, 1906-7, xvii. 429.

[29] Auer, J., "The Effect of Severing the Vagi or the Splanchnics or both upon Gastric Motility," *Amer. Journal of Physiol.*, 1909-10, xxv. 334.

[30] Klee, Ph., "Der Einfluss der Splanchnicusreizung auf den Ablauf der Verdauungsbewegungen," *Pflüger's Archiv*, 1913, cliv. 552.

[31] Smith, M. I., "The Action of the Autonomic Drugs on the Surviving Stomach," *Amer. Journal of Physiol.*, 1918, xlvi. 232.

[32] Thomson, J., "Observations on Congenital Hypertrophy of the Pylorus," *Contributions to Medical and Biological Research, dedicated to Sir William Osler*, New York, 1919, ii. 1010; also repr. in *Edin. Med. Journal*, 1921, new series, xxvi. 1.

[33] Thomson, J., "The Clinical Study and Treatment of Sick Children," 3rd Ed., Edinburgh, 1921.

[34] Miyagawa, Y., "The Exact Distribution of the Gastric Glands in Man and in Certain Animals," *Journal of Anat.*, 1921, lv. 56.

[35] Pavlov, I. P., "The Work of the Digestive Glands," trans. W. H. Thompson, 2nd Ed., London, 1910.

[36] Heidenhain, R., "Ueber die Absonderung der Fundusdrüsen des Magens," *Pflüger's Archiv*, 1879, xix. 148.

[37] Bidder, H. F., and Schmidt, C., "Die Verdauungssaefte und der Stoffwechsel," Mitau, 1852.

[38] Carlson, A. J., "The Secretion of Gastric Juice in Man," *Amer. Journal of Physiol.*, 1915, xxxvii. 50.

[39] Heyer, G. R., "Die Magensekretion beim Menschen," *Arch. f. Verdauungs-Krankh.*, 1921, xxvii. 227.

[40] Boldyreff, W., "The Self-regulation of the Acidity of the Gastric Contents, and the Real Acidity of the Gastric Juice," *Quart. Journal of Experim. Physiol.*, 1914, viii. 1.

[41] Bickel, A., "Experimentelle Untersuchungen über die Magensaftsekretion beim Menschen," *Verhandl. d. Kongr. f. innere Med.*, 1906, xxiii. 481.

[42] Kopeloff, N., "The Bacterial Content of the Stomach as Influenced by Saliva," *Proc. Soc. for Experim. Biol. and Med.*, 1921, xix. 110.

[43] Cannon, W. B., "The Acid Control of the Pylorus," *Amer. Journ. of Physiol.*, 1907-8, xx. 283.

[41] Edkins, J. S., "The Chemical Mechanism of Gastric Secretion," *Journal of Physiol.*, 1906, xxxiv., 133.

[45] Luckhardt, A. B., Keeton, R. W., Koch, F. C., and La Mer, V., "Further Studies on the Distribution and Extraction of Gastrin Bodies," *Amer. Journal of Physiol.*, 1919-20, l. 527.

[46] Rothlin, E., and Gundlach, R., "Étude Expérimentale de l'Influence de l'Histamine sur la Sécrétion Gastrique," *Archives Intern. de Physiol.*, 1921-22, xvii. 59.

[47] Beaumont, W., "Experiments and Observations on the Gastric Juice, and the Physiology of Digestion," Edinburgh, 1838.

[48] Rogers, J., Rahe, J. M., and Ablahadian, E., "The Stimulation and Inhibition of the Gastric Secretion which follows the Subcutaneous Administration of Certain Organ Extracts," *Amer. Journal of Physiol.*, 1919, xlviii. 79.

[49] Martius, F., "Achylia gastrica und perniziöse Anämie," *Med. Klinik*, 1916, xii. 481.

[50] Marris, H. F., "A Report upon the Use of Atropine as a Diagnostic Agent in Typhoid Infections," *Medical Research Committee: Special Report Series*, No. 9, 1917.

[51] Böhme, A., "Bemerkungen über das Vorkommen der Anacidität im Felde," *Med. Klinik*, 1919, xv. 113.

[52] Guillaume, A. C., "Les Réflexes Oculocardiaques et les Réflexes Vago-sympathiques; que peut-on attendre d'eux en Clinique? *Presse Med.* 1920, xxviii. 574.

[53] Brodie, T. G., and Russell, A. E., "On Reflex Cardiac Inhibition," *Journal of Physiol.*, 1900-1, xxvi. 92.

[54] Hartman, F. A., Waite, R. H., and Powell, E. F., "The Relation of the Adrenals to Fatigue," *Amer. Journal of Physiol.*, 1922, lx. 255.

[55] Roberts, Sir W., "Collected Contributions on Digestion and Diet," London, 1891.

CLINICAL RECORD

PASSAGE OF LATCHKEY THROUGH THE INTESTINAL CANAL.

By H. A. LEDIARD, F.R.C.S. Eng., Surgeon to the Cumberland Infirmary.

THE transit of foreign bodies through the intestinal canal is often remarkable and surprising, so that when these things are lodged it is not always wise to proceed immediately to operative measures.

The latchkey here represented (Fig. 1) measures $3\frac{1}{4}$ inches and weighs over $\frac{1}{2}$ ounce; perhaps the weight was a useful circumstance in the happy passage from mouth to anus.

The facts may be briefly stated:—A man of adult years was admitted into the Carlisle Prison in 1899, and told me that he had

FIG. 1.—The illustration shows the natural size of the latchkey—$3\frac{1}{4}$ inch; weight, $\frac{1}{2}$ ounce 58 grains.

swallowed a passkey for a pint of beer in a public-house. There were no symptoms to justify belief in this story, but special observation was kept and the man placed in what was known as the prison hospital, under suitable diet.

Although there was no sickness, diarrhœa, or particular tender area in the abdomen, the man held to his tale, and I obtained permission from H.M. Commissioners to get an X-ray examination made. For this Messrs Brady & Martin of Newcastle-on-Tyne sent over their plant and the man's abdomen was duly screened and plated, but without result.

It may be that I desired the upper abdomen, above the level of the umbilicus, pictured, and the key may have travelled further down at the time the X-ray was done. I now began to mistrust the man, and I think he may have left hospital, but shortly after the warder brought me the key which the man had passed *per vias naturales*.

I do not quite recollect how long the key was in voyaging through

the intestinal canal, but it was probably two to three weeks, and the whole time without any anxious symptoms being present. I have no doubt that uneasiness was there, and possibly the man made lighter of it all than another might have done.

I never met or heard of the man afterwards, but it is likely that if anything further had happened to him, I should have been acquainted.

Now I have a few other objects which have safely got past the pylorus and the ilio-cæcal valve, such as a salmon fish-hook, a dental plate with a sharp hook; but when a fork or knife may have been swallowed one can hardly look for a safe delivery per anum.

The lightest thing met with was a slender bone, part of the hæmic arch of the caudal extremity of a fish, like a cod, which stuck in the small bowel, caused violent pain, perforation abscess, and required abdominal section for extraction. The woman, a cook, middle-aged, made a satisfactory recovery.

The slender bone (Fig. 2) was somewhat a puzzle, but a

FIG. 2.—The bone weighs (dry) about 3 grains and was probably heavier when removed from the Abdomen.

section showed it to be really bone, and the final word was given by Dr Traquair of the Natural History Museum in Edinburgh, who located the bone in the tail of a fish.

It is not possible to guess how long the bone had been lying or moving about the body as the patient could give no reference to the occasion on which she swallowed it, but there was probably some adhesion checking general peritonitis. With a view to test the solubility of bone, I tried fish and chicken bones in test tubes with the normal proportion of hydrochloric acid solution, for a few weeks. It was found on weighing before and after standing in the tube, that diminution of weight was practically nil.

When a dog swallows bone, the bone is generally ground up into fragments and these pass through like gravel, but it is unwise to allow even a fish bone to escape the mouth unless reduced by action of the teeth.

NOTES ON BOOKS

The third edition of *Surgical Anatomy*, by William F. Campbell, M.D., F.A.C.S. (W. B. Saunders Company, price 30s.), has been thoroughly revised and a number of new illustrations added. The author has avoided the inclusion of much operative surgery, but when it does occur the anatomy of the operation is given prominence. The section dealing with the hand has been specially revised. The value of the excellent illustrations would have been greater had the anatomical structures in all cases been labelled. The description of cranio-cerebral topography is not so lucid as might be wished, but otherwise the subject is clearly dealt with. A section on bone ossification and development would have been welcome.

We have received a copy of the third edition of Sir Edward Sharpey Schafer's *Experimental Physiology* (Longmans, Green & Co.). This well-known practical guide is mainly composed of directions for carrying out experiments on nerve-muscle preparations. The directions are explicit and the numerous diagrams clear and helpful. There are chapters on the mechanism of secretion and the action of the heart and some experiments in connection with voice production and the special senses are described.

The Surgical Exposure of the Deep-seated Blood Vessels, by J. Fiolle and J. Delmas. Translated and edited by Charles Greene Cumston, M.D. (William Heinemann, price 8s. 6d.). Experience in the war has shown that the text-book methods recommended for ligation of the main blood vessels are often inadequate. The authors emphasise the importance of free exposure in difficult cases, and give a systematic and clear description of how to obtain the necessary access. The text is well illustrated.

In the fourth edition of *The Intensive Treatment of Syphilis and Locomotor Ataxia by Aachen Methods* (Baillière, Tindall & Cox, price 4s. net.), Dr Reginald Hayes emphasises the value of mercurial inunction in the treatment of various manifestations of syphilis, especially when carried out in strict accordance with the Aachen technique. That this method of treatment has a special place of its own, even since the introduction of salvarsan, cannot be denied.

The Venereal Clinic, edited by Dr Ernest R. T. Clarkson (John Bale, Sons, and Danielsson, Ltd., price 25s. net) is an excellent handbook of venereal disease in relation to the individual and the community, contributed to by several writers. Much valuable information is given on such vital matters as the prevention of venereal disease, the relation of the medical man to patients in a V.D. clinic, legislation and the practitioner.

Notes on Books

The Practitioner's Manual of Gynæcology, by A. C. Magian (William Heinemann, Ltd., 1922, price 21s.), contains a large amount of excellent material useful to the practitioner. The chapter on the clinical features and diagnosis of Extra Uterine Gestation is very well written and is easily the best piece of work in the book. A fuller illustration of operative procedures would have enhanced the value of the book, as the section on operations is short and somewhat difficult to follow. The cystoscope is included among instruments required for gynæcological diagnosis, but no mention is made of the curette.

Midwifery for Nurses, by Henry Jellett (J. & A. Churchill, 1922, price 9s. net), now in its sixth edition, is an excellent book simply written, but including all that a good nurse or midwife should know. The illustrations are numerous and good.

An Essay on the History of Electrotherapy and Diagnosis, by Dr Hector A. Colwell (William Heinemann, price 17s. 6d.), presents a full survey of the subject, tracing it through its many vicissitudes from the primitive use of the torpedo fish, whose electrical properties were valued in cases of paralysis and other ills supposed to be of nervous origin, down to the present day. The author shows how its progress has from time to time been hampered by the vagaries of quacks and how it has regained its status through the researches of such investigators as Jallabert, Galvani, Volta, Faraday, and Duchenne. The influence of the discovery of the X-rays by Röntgen, and of radium by the Curies on electro-therapy and diagnosis is illustrated. This book is of absorbing interest and should be read by all who study its subject.

The Principles of Electrotherapy and Their Practical Application, by W. J. Turrell (Henry Frowde and Hodder & Stoughton), is a book which should be read by all interested in its subject. The value of the therapeutic action of electricity is made evident both from the medical and surgical standpoint by the results obtained by the author. The first two sections deal with the apparatus used, the method of application, and the therapeutic action of the currents; the third with the value of electricity in diagnosis, and the fourth with results obtained in the treatment of certain diseased conditions. The work is well illustrated.

Radiations from Slow Radium, by John B. Kramer (Baillière, Tindall & Cox, price 12s. 6d. net.), is written by a member of the laity, and contains information regarding radium which may interest practitioners who employ this substance. Dr John Hall Edwards contributes a note on its therapeutic value, pointing out that he has found it of value in certain conditions, such as chronic superficial skin diseases, where a large area is involved for the treatment of which strong preparations are unsuitable. There is no index.

Edinburgh Medical Journal

November 1922

ŒSOPHAGEAL ACHALASIA.*

(A post-graduate lecture delivered in the University, 25th August 1922.)

By DAVID M. GREIG, C.M., F.R.C.S.E., Conservator,
Royal College of Surgeons' Museum, Edinburgh.

In March 1921, I communicated to the Edinburgh Medico-Chirurgical Society,[1] a paper on "Congenital Narrowing of the Œsophagus and its Relations to Cardiospasm and Œsophagectasia." My desire to establish congenital narrowing as a clinical entity was somewhat overshadowed by criticism being practically limited to cardiospasm—the commonest and most widely known of these conditions. But this criticism, together with a more extended perusal of the work of others, has led me to re-adjust the views on cardiospasm I then expressed.

Three factors exercise their influence on cardiospasm, viz., the anatomical, the physiological, and the pathological. These give the premises from which the conclusion drawn will be the more valid and trustworthy in proportion as they represent with accuracy our fullest knowledge.

Anatomical.—It is curious that the anatomical factor should require restatement, but old ideas are difficult to displace, and it has been tacitly accepted during generations that there is a special sphincter at the lower end of the œsophagus, in virtue of which food does not regurgitate during digestion nor flow out during inversion or stooping. Thus in a recent paper the author writes,[2] "The cardiac sphincter is a band of plain muscle fibre situated at the junction of the œsophagus and the stomach." In these days of microscopic accuracy of observation and of beautiful section-cutting technique, nothing should be easier than to demonstrate the presence of such a band in the fœtus did it exist, yet no observer has discovered it and no anatomical text-book records its existence. Were proof forth-

* α = without ; $\chi\acute{\alpha}\lambda\alpha\sigma\mu\alpha$ = relaxation.

coming, would our anatomists fail to record the *musculus sphincter inferior œsophagi*? The very fact that it has not been named should throw doubt on its existence. Keith indeed writes,[3] "At the lower end the œsophagus is also closed by a sphincter." Yet he surely does not claim an anatomical entity he cannot demonstrate, and he has elsewhere written,[4] "Rightly regarded, the œsophagus is a sphincter, drawn out and greatly extended by the development of the thorax. Like all other sphincters, it is in a state of tonic contraction." From the latter quotation no one will dissent, but there is a great difference between "the œsophagus *is* a sphincter" and "the lower end of the œsophagus *has* a sphincter." The œsophagus may be—indeed is—as the anatomist says, a potential sphincter, but it does not have at its lower end an anatomical sphincter, and the most recent work on the subject[5] fully bears this out. The truth is that the word "sphincter" is used somewhat loosely by many, and when they write "the action of the œsophageal sphincter" they mean "the sphincteroid (sphincteric) action of the œsophagus." The latter phrase is accurate and that action is only another name for tonus.

There is another anatomical structure which has received too scant consideration in this connection—the œsophageal opening in the diaphragm. It is not modified by the movement of the diaphragm, it practically retains an unvarying diameter, and beyond being the aperture through which the œsophagus passes, it has little relation to it. True, it limits the dilatation of the œsophagus in its circumference for it is not distensile, but that forms purely a mechanical relation between the structures. The opening might be congenitally small and might then give rise to symptoms; and that it might be congenitally unduly large, is also a possibility. Thus, it is recorded by Rigby and Wood Jones[6] that in the body of a female of over sixty years of age, they found: "The œsophageal orifice of the diaphragm measured 5·6 cm. in diameter; the muscular band which surrounded the left side of the orifice was highly developed, that on the left (*sic*) side was less so. The stage of the œsophagus, which lies normally within the abdomen (*sic*, diaphragm?) was dilated, drawn within the posterior mediastinum behind the pericardium, and covered on its left and anterior aspects by the left pleura. The line demarcating the œsophageal from the gastric mucous membrane lay above the level of the diaphragm, part of the cardiac end of the stomach filling the

œsophageal orifice. A circular fold of peritoneum was also drawn through the orifice with the cardiac part of the stomach." Another dissecting-room female subject aged sixty-five showed the same condition, only in a more marked degree. In spite of the consensus of opinion that it "was pathological, and due to a dilatation of the œsophagus," Keith was probably justified in considering the condition developmental—an abnormally large diaphragmatic œsophageal opening, permitting a degree of hernial protrusion.

When such difficulties and differences of opinion arise in what may be called gross anatomy, finer detail, such as nerve-supply, is apt to be relegated to the background. It is not sufficient to understand that the vagi with the mediastinal sympathetic, form the anterior and posterior œsophageal plexuses for the innervation of the œsophageal muscle, and that there are ganglia in the substance of the œsophagus, as occurs elsewhere in the alimentary tract, but it must also be realised that the œsophagus, in common with the lungs, has a parasympathetic supply from the bulbar area. All somatic (*i.e.* cerebro-spinal) nerves have their sympathetic quota, and the two are distributed in unison, but the œsophagus has a parasympathetic service as well. These anatomical facts must be borne in mind before the physiological question can be approached.

Physiological.—The exigencies of clinical work deprive the busiest of opportunities for continuing in efficient touch with every collateral subject, and modern physiological research becomes a bypath, along which the surgeon rarely casts even a passing glance. Engaged in amassing clinical experience, one is apt to become a sciolist in other branches of medicine, and advances even of great importance may be overlooked or undervalued. Where is the medical writer to whom some such reflection has not many times recurred? To what subject is such reflection more relevant than to physiology?

Sherrington it was[7] who brought before the profession generally the importance of muscular "tonus," and who urged the recognition of autonomic nerves as a practical factor of the utmost importance in every branch of medicine and surgery. Indeed their materialness is observable throughout the entire animal kingdom, and many of the most striking instances of their power and utility may be obtained among the invertebrata. The old conception of muscle as being either in activity or at rest must be modified, and, with the recognition of "tone"

muscles cease to be sharply divisible into voluntary and involuntary. Reflex tonus retains each muscle—each fibre—ready for instant use, and it is automatically maintained in response to slight, constant, but unappreciable stimuli, and it is exerted at a minimum expenditure of energy. Volition is supplied through the cerebro-spinal (somatic) nerves, but tonus is maintained through the sympathetic. Every "voluntary" muscle has an involuntary tonus. It is thus that the erect position is maintained, the "voluntary" muscles are "toned" to balance, and there is no conscious effort in it, and only after very prolonged use may fatigue be experienced. Were it otherwise, gravity and the ligaments could keep the body erect after death. Such a feat has never been accomplished. It is muscular power which prevents collapse. Consciousness may be absent yet "tonus" may remain. In normal muscle the degree of tonus may vary, being higher, so to speak, during excitement; the "voluntary" muscles being involuntarily held ready for the expected exertion.

As it is with skeletal muscles so it is with visceral. Thus, the bladder—never a flaccid organ—alters its tonus from time to time, accommodating itself automatically until repeated stimulation passes from unconscious tonus to conscious desire. Yet in this viscus the intelligent brain, should circumstances not favour micturition, can by voluntary effort re-adjust the tonus and so postpone the reflex evacuation of the vesical contents.

It was on physiological grounds that Langley[8] differentiated the tectal and bulbo-sacral nerves from the thoracico-lumbar sympathetic and gave them the distinctive name of parasympathetic system. It is on anatomical grounds, however, that he still keeps the enteric innervation as a separate system of the autonomic nerves. Langley therefore divides autonomic nerves into three systems—the sympathetic, parasympathetic, and enteric; and the parasympathetic he subdivides into tectal (ocular) and bulbo-sacral. Clinically all these have much in common. The œsophagus is supplied by cerebral nerves, by thoracic sympathetic, and by bulbar parasympathetic, but the exact proportion, relation, and termination of the several varieties have not yet been determined.

The œsophagus contains both striated and non-striated muscle, yet, as Langley says, "there is no evidence that the striated muscle of the œsophagus can be contracted voluntarily."

It is a reflex act set up by a definite stimulus. We cannot look upon the œsophagus at any time as a flaccid tube. It too has its "tonus." Like the elongated sphincter it is, it is always in a state of tonic contraction, ready for the reflex act of swallowing when the stimulus is forthcoming. It is doubtful if the normal œsophagus ever contains air as Mickulicz has suggested.[22] The air-space is a feature in the radiography of the stomach, and air in the intestine or gas within the peritoneum may alter the radiographic picture in these regions, but the radiogram that casts a shadow of the œsophagus does not show a content of air. A little air passes down with the food and is retained or regurgitated, but it is more than doubtful if any ever remains within the œsophageal lumen. Apparently the tonus of the œsophageal muscle is sufficient to maintain the tube gently closed, though the ease with which eructation occurs suggests that the normal closure is not very tight. In normal deglutition the bolus transmitted to the œsophagus by the pharyngeal muscles passes rapidly through the upper strait so as to clear the larynx, and in no way to impede respiration. The movement then becomes a comparatively leisurely one, the œsophagus yielding below while it contracts above, until at the lower end the contents trickle or are pressed through in a more or less continuous stream, the tonus ensuring that the food shall not be dropped in lumps at intervals into the stomach. The feature of postural contraction, says Sherrington, is the maintenance of a muscle at any length, with the greatest economy of metabolism and with the greatest freedom from fatigue. Passive postural contraction counteracts such other forces as tend to disturb the relation of parts. The tonus of a sphincter is active postural contraction.

Pathological.—In all varieties of œsophageal obstruction the essential clinical feature is dysphagia. In congenital deficiency the anatomical structure is at fault, in all others it is the function that is deranged. Though it is necessary in studying the physiological disturbance, to have a clear conception of the anatomical arrangements, the crucial factor in spasmodic obstruction must be the innervation of the muscles. We have seen what a complicated matter that innervation is, and we know that, though in cerebro-spinal nerves a recognisable degeneration may accompany disturbance of function, little analogous knowledge is yet available concerning the autonomic nerves. The ultimate illation, therefore, must be by deductive,

since the absence of ocular proof of nerve degeneration precludes inductive reasoning.

The division of spasmodic dysphagia into hysterical, true, and paralytic is designed rather to suit the physician than to provide a scientific classification, and when hysterical dysphagia is recognised "because the bougie passed easily"[9] the limit of paralogy seems reached. Hysteria is a disturbance of control in which the autonomic nerves are certainly, perhaps chiefly, implicated, and the manifestations are not entirely cerebral. What else is the rigidity of the hysterical "fit" than hypertonus of muscles in spasm beyond volition?

The following is an example of hypertonus, though not entirely œsophageal. I had under my observation during a decade a man who, when I first saw him, was 31 years of age. His complaint was "difficulty in swallowing since 3 years old," but this statement I found to be misleading and inaccurate. His mother was aged 70 and defective in memory; his father had died aged 62 of hemiplegia; two children died in infancy (still-born?), and an older sister was said to be "well." Though he had previously attended hospital as an out-patient, his first admission was at the age of 3 years, and it was then noted that frequent vomiting and recurring abdominal pain had existed since birth. He was bottle-fed; a small, puny, delicate child. The diagnosis made was that of chronic gastric catarrh, but no improvement followed treatment. At the age of 8 years he was in the Edinburgh Royal Infirmary for a short time, and immediately after that was admitted to the Royal Hospital for Sick Children, where he remained during two months with little or no improvement. He went to work in the mills at the age of 11 and could then swallow some solid food. At the age of 24 he married a stout healthy woman of about his own age. He has had two children, one a girl aged 6 years healthy and well, and one who died aged 1 year of inflammation of the lungs. He is 5 ft. 3 in. high, and weighs 7 st. 2½ lbs. in his clothes. His appetite is good and his lips of moderately good colour. His pain is epigastric and abdominal, not thoracic unless food sticks in deglutition. His first experience of real œsophagospasm occurred at the age of 26, when a piece of beef stuck in his gullet. In the evening of the same day he vomited a little blood, probably the result of trying to provoke emesis. The obstruction remained during two days when, on taking a dose of "black draught," he felt something slip down, and he was

conscious of sudden relief and of immediate return to his normal.

His discomfort had recently increased when I first saw him, and on examination under general anæsthesia I found the largest size of œsophageal bougie arrested at twelve inches from the dental margin, but there was no difficulty in passing a smaller size and then substituting the larger. He thought this gave him a little, though very temporary (three days), relief. In the following year, after an occasional attack of diarrhœa, occasional vomiting (regurgitation?) and an increase of his abdominal pain, he applied for re-examination. Radiographic observation showed that there was no difficulty in the passage of food. The barium bolus passed through the œsophagus with unusual rapidity. There was evidence of great gastric peristalsis as the meal was at once carried through the stomach and duodenum into the jejunum. It was probably to the rapid transmission of undigested food that the diarrhœa was due. It suggested that condition of gastric irritability (hypertonicity?) in infants which is so effectually relieved by the exhibition of opium, yet here opium in a congenital weakness was scarcely a justifiable prescription. His was obviously not a case for surgical interference, and, dissatisfied because "nothing was done," he left hospital.

During the subsequent eight years he frequently attended and was occasionally admitted to the medical wards, where the diagnosis hovered mostly around pernicious anæmia though nucleated red corpuscles were never found, until in 1920 examination of his blood showed his Wassermann reaction to be definitely positive. The possibility of inherited syphilis then became apparent and seemed to fit the facts and account for his unstable nervous system with autonomic disturbance; an obvious illustration of the paramount necessity of obtaining the Wassermann in every obscure abdominal case. Though at times in this instructive case there had been definite œsophagospasm the excitability of the gastric nerves and of the enteric autonomic system generally was a much more important clinical feature.

The converse of this, namely "hypotonus," is less easy of demonstration, at any rate in its less degrees in the œsophagus, than in some other organs. In the viscera it is an everyday reality to the physician as chronic constipation, while in the skeletal muscles it is an everyday reality to the surgeon as

scoliosis and other postural deformities, as has been so ably pointed out by Bankart.[10] Functional scoliosis, he writes, is due to the deficiency of the habitual subconscious state of reflex activity, which normally maintains the erect attitude, and this equally applies to every condition of tonus. Hypotonus can often be rectified by effort, but not for long. It is this effort which enables a certain type of "neurasthenic" to go to a dance, but it is the exhausted tonus that keeps her in bed next day. Barclay[11] gives some good examples of mental effect on the tonus of a viscus in discussing the radiography of the normal stomach. He records that watching the normal shadow on the fluorescent screen, he has seen tonus relaxed and the lower outline of the stomach drop through a few inches by impending loss of consciousness, by sudden alarm, by apprehension, by nauseating smells, etc., and on the other hand has noticed the production of hypertonus from pleasant suggestions, the smell of appetising food, and so on.

The œsophagus can be no exception to such regulation. What irritates or excites its nerves will produce hypertonus; what deteriorates its nerves will produce hypotonus. In the former we have œsophagospasm. There is a difficulty in relaxation, and this justifies Hurst's[12] appellation of achalasia. The word is good. It conforms to what all nomenclature should, being precise, descriptive, suggestive of details allied to the particular condition, and in not being cumbersome. But his phrase "achalasia of the cardia" is not so satisfactory, because œsophageal achalasia may be general, or it may be localised to any part of the tube, and is not the prerogative of the cardia.

There may be some local cause for this hypertonus in undue stimulation from the œsophageal lumen. Thus the drier, coarser, and rougher the food, the more difficult is deglutition, because the reflex stimulus ensures more prolonged muscular contraction. While more serious excitation of the œsophageal nerves, as by a foreign body, by ulceration,[15] by an escharotic, or even by the pressure of a tuberculous bronchial gland,[24] will produce a more severe reaction, as will also irritability from indigestion and hyperacidity, of which I have previously reported a case,[13] as well as stimulation of nerves by mental impression or by disease.

In Kelly's case[14] the blocking, at the level of the aortic arch of a normal adult œsophagus by a pultaceous mass the size of a pea, could only be due to achalasia following reactionary

spasm. The œsophagus *is* a sphincter, it is in a state of tonic contraction, and χάλασμα (relaxation) takes place in advance of the bolus, not in virtue of the mechanical action of the œsophageal contents, but as part of the correlated action through the œsophageal nerves.

Anatomically and physiologically, therefore, achalasia is possible. Clinically its existence has been always known, and the innervation and musculature of the œsophagus can explain its presence without the existence of a special sphincter. The want of recognition of this fact has led to much misunderstanding and confusion. The clinician describes the syndrome, the pathologist offers an acceptable though erroneous explanation, and then the blind leads the blind for generations, most of the time being spent in scrambling out of the anatomical ditch into which they have been constantly falling. How much better were the anatomist to open their eyes by unequivocally telling them there is no special anatomical sphincter! A hundred years ago Alexander Munro[16] was probably correct when he wrote, "Spasm of the gullet is partial or general; and the partial constriction is most common at the union of the gullet with the stomach," but he had no warrant for the statement, "A permanent organic stricture is frequently a consequence of a spasmodic stricture of some duration." It is claimed for achalasia that it may lead to hypertrophy or paralysis of the œsophageal muscle. But achalasia does not stand to hypertrophy or paralysis as cause to effect. Had it been beyond the bounds of possible imagining that prolonged spasm (want of relaxation) could produce proximal hypertrophy, the theory would never have gained the acceptance it has, but the perusal of the published cases shows that the hypertrophy is not that which must take place were spasm the sole affection. The alleged hypertrophy is consequent on the obstruction, the tissues elsewhere are supposed to be healthy, and the hypertrophy is brought about by overaction of the muscles. Were that admitted, does the pathological finding coincide? It does not, because whereas all muscles would combine in effort, they are not all hypertrophied. In the immense majority it is the circular fibres which undergo overgrowth while the longitudinal coat either remains unchanged or undergoes atrophy; whereas in much rarer cases it is the longitudinal muscle which is hypertrophied, and the circular remains of usual thickness or has become attenuated. Again, were the localised achalasia the

cause of the proximal overgrowth from effort, the distal part of the œsophagus should remain normal or undergo atrophy; yet, though it is not being used because the spasm will not let food through there are quite a number of cases published in which the fibres of the circular coat, distal to the obstruction, have undergone hypertrophy, and a few in which the cardiac end of the stomach wall has shown overgrowth of some of its fibres, as would be expected seeing it has the same vagal (parasympathetic) supply.

Of these well-established clinical facts and these post-mortem findings, no better explanation can be offered than that it is not the muscles that are primarily at fault but the nerves, and these nerves the sympathetic or the parasympathetic or both. The bulbar origin of the œsophageal parasympathetic nerves is apparent in Thomson's [17] case of dysphagia, with unilateral paralysis of the vagus and bulbar nerves. At their periphery, at their centre, or in their course, a disturbance of nerve influence has taken place. A want of balance and co-ordination is set up, and localised achalasia results generally on slight provocation (swallowing), and there, if the muscle remains healthy, the matter ends; but should enervation of the muscles lead to want of power in one set, the other will undergo compensatory hypertrophy. Cases are not wanting which have been reported as "cardiospasm," in which general dilatation of the proximal œsophagus has taken place without obvious overgrowth or with obvious atrophy of muscle. Here I hold the primary lesion is a nerve one and the primary disturbance a functional paralysis. No achalasia—no spasm really exists. It never does. The lesion is often discovered more or less suddenly, though it may have been coming on very gradually during years, and the only obstruction which exists is caused by the œsophageal opening in the diaphragm not participating in the general relaxation, since quite apart from the innervation of the diaphragm the size of the opening is structurally fixed.

Causes of disturbance of the autonomic nerves are not far to seek—they may be found in any part of the organism—and causes of paralysis, though fewer, are common enough. I need only mention diphtheria,[23] any infectious fever, syphilis, influenza. In the interesting case of a woman, aged 36, in whom dysphagia began at 17, reported by Bertolotti and Boidi-Trotti,[18] though the diagnosis of "paralytic dilatation, without anatomical cause, by spasmodic stenosis of the cardia"

was made, surely pathological cause is not difficult to suppose from the woman's previous history; for at 6 years she had had scarlet fever, at 8 years a five months' illness of an inflammatory nature with an abscess at the malleolus, and, a year before the dysphagia began, she had a submandibular abscess. The toxic outcome of such a life-history might well have been a general deterioration of tonus; in this particular case the peculiarity consisted in the severity and localisation of the lesion; and though as a paralytic affection it would be thus conceivable, as a spasmodic affection it would be inexplicable. Any disease indeed that may leave nerve effects, especially exhaustion and weakness, may temporarily or permanently affect the œsophagus.

Are there in other parts of the body any conditions analogous to these œsophageal affections? I need only again refer you to the colic—the spasms, the irritability, and ultimately the functional loss of tone in the gastro-intestinal tract or the urinary organs in cases of locomotor ataxia; and for a condition which seems clearly analogous to œsophageal dilatation and functional disturbance, I would refer to megacolon—congenital idiopathic dilatation. Here there is a particular segment of the bowel unable to utilise its distal opening which is not diminished in size. There is no obstruction, kink, valve or bend. It is not the junction at the sigmoid nor at the rectum which is at fault but the proximal bowel. Keith[19] has thought he could distinguish pathological changes in the cells of Auerbach's plexus in colons excised from muco-membranous colitis; and M'Carrison[20] records changes in the ganglion cells of the mysenteric plexus in monkeys in which the colon had undergone pathological degeneration—the result of improper feeding. If these be true, megacolon is likely to yield as definite an evidence of nerve disturbance as the hypertrophy of its circular fibres and the absence of overgrowth in its longitudinal coat yields of affection of its muscles. The affected portion corresponds to one of Keith's neuro-muscular sections referred to by Langdon Brown[21] in his Croonian Lectures on the sympathetic nervous system in disease, and explains the limitation of the affection to that portion of the bowel, as the analogous œsophageal affection may be limited to the œsophagus.

REFERENCES.—[1] Greig, D. M., "Congenital Narrowing of the Œsophagus and its Relation to 'Cardiospasm' and Œsophagectasia," *Trans. Med. Chir. Soc.*, Edin., vol. xxxv., n.s., p. 191, Edinburgh, 1920-21. [2] Turtle, G. de Bec.,

"Spasm in the Alimentary Tract," *Lancet*, London, 25th Feb. 1922. [3] Keith, A., *Human Embryology and Morphology*, p. 271, 4th Ed., London, 1921. [4] Keith, A., "Anatomical Evidence as to the Nature of the Cæcum and Appendix," Proc. Anat. Soc. (*Journ. Anat. and Phys.*, vol. xxxviii.), London, Nov. 1903. [5] Jefferson, G., Proc. Anat. Soc. (Edinburgh Meeting), 1922. [6] Rigby, H. M., and Jones, F. W., "A Partial Hernia of the Cardiac End of the Stomach through the Œsophageal Orifice of the Diaphragm," Proc. Anat. Soc. (*Journ. Anat. and Phys.*, vol. xxxvi.), London, Nov. 1901. [7] Sherrington, C. S., "Postural Activity of Muscle and Nerve," *Brain*, vol. xxxviii., p. 191, London, 1915. [8] Langley, J. N., *The Autonomic Nervous System*," Part I., Cambridge, 1921. [9] Habershon, S. O., "On Dysphagia," *Guy's Hospital Rep.*, vol. ii., 3rd ser., p. 208, London, 1856. [10] Bankart, A. S. B., "Postural so-called Static Deformities," *Brit. Med. Journ.*, vol. i., pp. 587 and 636, London, 1921. [11] Barclay, A. E., "The Normal Stomach," *Lancet*, London, 5th Aug. 1922. [12] Hurst, A. F., "Achalasia of the Cardia," *Quart. Journ. Med.*, vol. viii., p. 32, London, 1915. [13] Greig, D. M., "Cardiospasm, Congenital Narrowing of the Œsophagus and Œsophagectasia," *Edin. Med. Journ.*, vol. xxvi., p. 342, Edinburgh, 1921. [14] Kelly, A. B., "Stenosis at the Lower End of the Œsophagus with Special Reference to those of Gastric Origin," *Brit. Med. Journ.*, p. 1049, 19th Oct. 1912. [15] Smith, E. B., "Œsophageal Stricture," *Proc. Roy. Soc. Med.* (Sect. Child. Dis.), vol. xv., p. 1, London, 1922. [16] Monro, A., "Observations on Spasmodic Contraction of the Passages for the Food, the Bile, and the Urine," *Edin. Journ. Med. Science*, vol. ii., p. 14, Edinburgh, 1826. [17] Thomson, St C., "Dysphagia with Unilateral Paralysis of the Tenth and Bulbar Nerves," *Trans. Clin. Soc.*, vol. xxxii., p. 264, London, 1899. [18] Bertolotti and Boidi-Trotti, G., "Le Radio-Diagnostic dans un cas de Dilatation paralytique de l'Œsophage," *Nouv. Iconog. Salpêtr.*, tome xx., p. 335, Paris, 1907. [19] Keith, A., "An Account of Six Specimens of the Great Bowel removed by Operation: with some Observations in the Motor Mechanism of the Colon," *Brit. Journ. Surg.*, vol. ii., p. 576, Bristol, 1915. [20] M'Carrison, R., *Studies in Deficiency Disease*," p. 108, London, 1921. [21] Brown, W. L., *The Sympathetic Nervous System in Disease*, p. 91, London, 1920. [22] Kantor, J. L., "A Study of Atmospheric Air in the Upper Digestive Tract," *Amer. Journ. Med. Science*, vol. clv., p. 829, Philadelphia, 1918. [23] Rugh, J. T., "Vaso-Motor Intestinal Paralysis following Diphtheria—Recovery," *Archiv. Pediat.*, vol. xxiii., p. 764, New York, 1906. [24] Adams, S. S., "A Case of Spasmodic Stricture of the Œsophagus," *Archiv. Pediat.*, vol. xxvi., p. 170, New York, 1909.

CONGENITAL HYPERKERATOSIS.

By W. E. FOGGIE, M.D., M.R.C.P.E., Extra Physician, Dundee Royal Infirmary; Lecturer on Clinical Medicine, St Andrews University.

THE following case of congenital hyperkeratosis is put on record not only on account of its rarity and the long period it has been under observation, but also because it adds a small contribution of clinical interest to a subject that is still full of difficulties, whose solution can only come from the examination of many cases.

CASE.—M. F., female, born in 1907, is the tenth child of a family of thirteen. Her parents are alive and well. Neither they nor any of the rest of the family have ever suffered from any disease of the skin. There is no consanguinity between the parents.

The birth was normal, and was at full time. The child was of good size, and appeared healthy. The amount of liquor amnii was not excessive, and the vernix caseosa was slight. After the baby was washed, it was noticed that the child had a peculiar red puffy appearance. The same evening the skin looked hard and shiny, and on being touched was felt to crackle especially at the joints. The eyelids were rather red, and were discharging. The nose seemed to be stuffed up with a whitish material which could not be removed. Next day there was some improvement, but the face and the head were still very swollen. Within two days the nostrils were clear. The cord came away on the fourth day. In four days the skin had begun to peel off in many parts. The desquamation began first on the back of the thighs and the legs, and later on the front of the thighs and the abdomen. There was a steady improvement in the health of the child, which was taking the breast well, but the condition of the skin continued to give great trouble. This hard collodion-like first external skin was only thrown off gradually, so that at the end of three weeks it had only come away completely from the thighs and the abdomen. This initial covering was succeeded by a lighter flake-like desquamation. A good idea of the appearance of the various stages of desquamation in the child can be got from the photographs (1 and 2) taken when the infant was about three weeks old. They show a well-developed infant with a face still somewhat swollen, especially in the upper part. The eyelids, thickened and a little rigid, show through their rather close apertures eyes somewhat deeply set. The mouth, which shows some eversion of the lips, is kept widely open. The conjunctivæ are quite clear. The skin generally illustrates, in a very graphic way, the various stages of the desquamation, which is curiously different on different parts of the body. The actual state of the skin

is represented roughly in three ways:—(1) original covering; (2) area of desquamation, and (3) an area of apparent cure. The original covering is still shown in numerous circular patches over the back and head, in isolated patches on the upper arms and on most of the legs below the knees. This first skin is thick (about one-eighth inch on some parts), and firmly adherent to the underlying layers. The surface is smooth, dirty fawn in colour, with curling at the frayed edges. In the area of desquamation, the scaling is mostly flake-like but over the scalp it is more seborrhœic. The thighs and lower back show for the moment an apparent cure. Fissures radiating from the angles of the mouth are becoming evident. At three months the ichthyotic-like character of the skin lesion was becoming everywhere more distinct as the previously noted healthy areas were now also freely scaling. A few of the patches of the first skin still persisted. The ears were still filled with scales from the first desquamation. There were no eyelashes in the lower lids. The hands were kept closed. At five months the first skin was practically away except on the point of the nose, the fingers and the toes. The eyes had now a sunken appearance, from the tense eyelids not allowing the application of the eyelids to the eyeballs.

It thus came about that at the end of six months this infant, born with a thick, hard, covering layer, had completely shed it, and thereafter entered on its future life with a general widespread keratotic condition, which has persisted ever since.

The child with this now well-established ichthyotic generalised condition of the skin, has been seen at frequent intervals during the past fifteen years. The general health has been well maintained. She began to walk at the usual age. The mentality is very fair but the physical disability hindered for a time her education. Latterly she has made considerable progress at an invalid school.

It would be tiresome to describe in detail the changes in her life from year to year. Mother and child both gradually became more or less reconciled to the handicap imposed by this apparently intractable disease. The great drawbacks have been the unpleasant appearance of even the hands and face and the continuous desquamation. Mentally the child has also shown a natural shyness and reserve, and a tendency to keep the head well bent to avoid the gaze of the passer-by.

Perhaps the best way to give one an idea of the child is to describe her appearance in early adolescence. It is especially in the face that the hard tightening tendency of the skin is apt to produce the features which are so characteristic of the disease.

The child then at the age of 12 was of fair development but somewhat undersized for her age. The height was 3 ft. 10½ ins.; the weight 3 st. 11½ lb. The general health was good. All the systems

except the integumentary appeared normal. There were no obvious glandular enlargements. The thyroid, it is true, did not appear very well defined. The thymus was not enlarged to percussion. The general movement of the limbs was not impeded.

The head was still covered with numerous scales except on the top, where the hair was very thin and the skin was bound to the scalp. There was a considerable ring of hair beyond this but farther out towards the hair-margin the hair was again thin. The hairs which were rather thin and wiry were matted together in some places with crusts.

The face which had the skin stretched tightly over it, is comparatively clean, though one or two fawn-coloured patches were present on the cheeks, the forehead, and the nose. There were very few hairs in the right eyebrow and still fewer in the left. There were eyelashes in both upper eyelids but very few and very small ones in the lower. The palpebral fissures were still kept widely apart by the stiff thickened eyelids. Some ectropion persisted. There was some roughening at the outer canthi. The nose appeared very dry with some crusting inside. The ears were very stiff and tended to be pressed back towards the skull. There was a dry scaliness in the meati. The mouth could now be kept closed and the tendency to eclabium had largely passed away. There were radiations from the angles of the mouth but there were no actual cracks.

In the neck there was a considerable collar of scales especially in the lower part.

The trunk showed in front a fair amount of scaling especially over the abdomen. The most noteworthy thing was that the scales had a more or less quadrilateral shape as a result of the transverse and vertical fissuring. Over the back the oblique fissures which pass downwards and outwards from the mid-dorsal spine on each side gave a less defined pattern.

The arms showed the same ichthyotic condition especially at the axillæ and the extensor surfaces of the elbows. The skin was much darker at the axillæ and in front of the elbows. The forearms were clearer and slightly moist. The hands were long and tapering and simian in type. The palmar surfaces were hard and smooth. The fingers tended to turn in. The backs of the hands were more scaly. There was a large wart over the articulation between the first and second phalanges on the back of the right ring finger. The nails were elongated and showed curving both longitudinally and transversely, especially the thumbs and the little fingers. There were transverse striæ and numerous lunules.

The lower extremities exhibited the same scaling but on a larger pattern. The condition was specially marked at the knees and over the legs and the dorsal surfaces of the feet, where it tended to be much

darker. There was a slight tendency to moisture in the popliteal spaces. The toe nails were long, thick, and curved like horns. The toes were all bent into the centre and dovetailed themselves into each other. The soles were fairly smooth and inclined to be dark and scaly.

All the above description, which is in complete agreement with the present-day appearance, is very well brought in the accompanying photograph (No. 3), taken two years ago.

At the present time the girl has grown (height now 4 ft. 6 in.) and is much stouter (weight 5 st. 13 lb.). Menstruation set in a year ago at the age of 14. It has been regular and normal in amount except on the first occasion, when it was a little excessive. Her appearance is still infantile. The breasts are now distinct but there is no hair in the axillæ or on the pubes. She is bright and cheerful and likes her school, but her education is backward. She perspires freely at times, not only on the palms and soles but also over the body. All the nails are inclined to grow quickly. Treatment has mainly consisted in the application of vaseline which always gives her relief by softening the hardened skin and preventing cracking with the possibility of inflammatory complications. A short trial with thyroid did not offer much help. Her general health has been always quite good. She has never had any illness except a mild attack of measles in early childhood.

The above case represents a typical example of the milder variety of the skin disease known as congenital ichthyosis, fœtal ichthyosis, congenital hyperkeratosis, etc., according to the date of the record, the severity of the disease, or the individual view of the reporter. Before discussing the special clinical characteristics of this patient, it is advisable first to consider the grave type of which this is a lesser degree. Thereafter it will be possible to hint at their relation to each other and their joint relation to ichthyosis vulgaris.

The grave form, sometimes called congenital malignant keratoma, is the "harlequin fœtus" well known to all by its illustration in many books on embryology and obstetrics. The infant, born often before full time, is covered with huge scales and shows various defects of mouth, eyes, and ears. It generally dies soon from inability to suck or from septic complications. The essential elements then are: (1) the universal scaling, and (2) the associated defects of ectropion, eclabium, etc. Now in addition to this grave type there is a milder, in which both essentials are modified so that the scaling is less, and most important of all, the eclabium is not so severe, and consequently the child is able to suckle

2321

FIG. 1.—Photograph showing child at three weeks old.

FIG. 2.—Photograph showing back of child at three weeks old.

FIG. 3.—Photograph of girl at age of twelve, showing general appearance with the special arrangement of the scaling.

and live. It is then to this latter group that the patient belongs.

The striking appearances in the grave form naturally led to its early recognition and was no doubt likely to lead to its being recorded in most cases. It is not a common disease. Ballantyne,[1] in 1895, in a very comprehensive survey of the literature up to that date, could only find thirty-seven cases of this type; the number added since is not very large. Some idea of its rarity may be got from the fact that M'Auslin,[2] in reporting a case last year from the Edinburgh Maternity Hospital, states that his is the first one from that Institution for fifty years.

Ballantyne classifies his cases into two forms: (*a*) the grave and (*b*) the mild. Riecke,[3] five years later, in a general review, mentions three types: (*a*) ichthyosis congenita—the harlequin or grave form; (*b*) the larval, corresponding to the mild; and (*c*) ichthyosis tarda, in which later after birth a similar condition even to the facial deformities may develop. This last group which was formed to include two cases of Lang is illustrated by a recent case of Riehl.[4]

The milder or larval cases which now demand consideration were later in being recognised than the grave, the first according to Ballantyne being that of Seligmann in 1841. Ballantyne describes thirty-three in all, and this group like the grave has had only a moderate increase since.

The milder type shows considerable variation in the degree of the affection, and thus its clinical characteristics are not absolutely fixed. Still the main clinical elements that go to make up the picture are quite easy to outline. In common with the grave form it shows generally an absence of heredity, but there is frequently a family prevalence. At birth the skin is completely covered with a smooth lining described as collodion, parchment, etc., by different authors. This skin desquamates sooner or later and is followed by fresh desquamation. Once the desquamation is fairly established, the scaling which proceeds in different ways on different parts gives rise to a quite clear picture. Thibierge and Legrain,[5] who have drawn special attention to this, mention especially the thick area around the neck, the quadrilateral character of the ridging on the front of the trunk and the oblique on the back, and the varying size of the scaling on the different parts of the limbs.

In addition to the facial deformities, Thibierge and Legrain lay special stress on the keratodermia of the palms and the soles with an abundant accompanying hyperhidrosis. The rapid growth of the nails is also very evident.

The number of cases of the mild form is beginning to increase since more attention has been drawn to it. Amongst later cases since Ballantyne's[24] second communication of 1902 may be mentioned those of da Costa,[6] Brandweiner,[7] Sequeira,[8] Golay,[9] Jordan,[25] and others. The prognosis as to life is good in many cases. As far back as 1898 Thibierge[10] had reported two cases which had reached the ages of 15 and 18 respectively, and later Thibierge and Legrain[5] add two more of ages 14 and 27. Amongst others Bowman[11] reports one aged 7, Litchfield[12] a girl of 8, and Brandweiner one of 5.

The outcome of the skin condition is less promising. In some, such as the above case, it persists practically unchanged. Others of a milder type pass on to a state exactly resembling ichthyosis vulgaris, as in the case of Seligmann mentioned by Ballantyne.[1] Some clear completely, but these are more probably a natural physiological shedding of the skin.

Almost all are agreed that the milder type is the lesser form of the severe type or harlequin fœtus, but Thibierge and Legrain say there is no proof of this.

In contrast to these severe and mild types of congenital hyperkeratosis there is the well-known ichthyosis vulgaris which, though presenting apparent points of resemblance, is yet separated by many sharp differences, such as its origin only in the second year of life, its distribution, its frequent marked heredity, and its freedom from deformities of mouth, eyes, etc.

To many, nevertheless, nowadays the line of demarcation is not so sharp as it was once supposed to be. The existence of so many mild varieties of the fœtal form and the ultimate clinical picture resulting in some of the slighter cases has led several, and especially Méneau,[13] to consider all forms of general ichthyotic disease as but manifestations of one process, which is modified according to its origin before or after birth, and also according to its extent and its severity. For Méneau all these slighter forms are but links in the chain of this one disease. Bruhns,[14] who has collected many of these transition cases, considers that while there are distinct clinical types yet there is no justification for considering them as something quite separate. Bering[15] from

the pathological side likewise holds that there is no sharp line of demarcation. Thomson and Wakeley,[16] in their recent and elaborate study of the disease, say that the harlequin fœtus is more closely allied to ichthyosis than to any other condition. In the skin of the harlequin they find the epidermis enormously thickened, but the whole thickening composed of horny layer with exaggerated papillary elevation and inter-papillary epidermal ridges, while ordinary ichthyosis only differs in the relative width of the papillæ and the inter-papillary ridges. Lastly, Macleod[17] remarks that "it was believed that these extensive congenital cases were of a different nature to ordinary ichthyosis and the name 'hyperkeratosis universalis congenita' was applied to them by Unna; the general trend of opinion. now is that they are different degrees of a common pathological process."

The pathogenesis of this disease leads at once into the region of surmise. A congenital anomaly of the skin is the solution offered by some. Others, *e.g.* Renshaw,[18] find in the persistence of the epitrichial layer a sufficient answer to the riddle of congenital ichthyosis, even though Bowen[19] who first brought it forward as a possible explanation of some very mild cases, considered that advanced cases could certainly not be accounted for by it merely. A curious view has been put forth recently by Golay,[9] who describes a family of which several members were affected by ichthyosis. The mother stated that with each pregnancy she had "longings" for salt, and in each pregnancy in which she yielded to this the child was at birth ichthyotic. Golay explains this as due to some toxæmia. The theory to which present-day research is lending most support is the endocrine. There are indeed certain very significant facts which call for some explanation. Wassmuth[20] reported many years ago a case of congenital ichthyosis in which both parents were cretins. About the same time Winfield and van Cott[21] described a case in which there was a complete absence of the thyroid. Some years later Moore and Warfield[22] found in a case an atrophy of the thyroid and the thymus glands. The thymus was analogous to the condition found in senile atrophy of that gland, and contained much connective tissue, while the thyroid resembled the atrophic thyroid of sporadic cretinism. Hess and Schultz[23] have recently noted the thyroid undifferentiated and not functioning in a case of theirs. Lastly, Thomson and Wakely[16] have described most carefully from this point of

view two cases. In the first the thymus was enlarged and the thyroid was relatively small: microscopic examination showed the thymus with large numbers of the corpuscles of Hassal, an indication of activity; while in the thyroid, though many vesicles were filled with colloid, many cells had not yet taken on glandular arrangement. In their second case also from the same family the thymus was again active. In the thyroid the normal glandular structure had almost disappeared, the vesicles being merely vaguely outlined and indistinctly divided by the septa. There was also an increase of the fibrous tissue. They consider the condition is an error of development connected probably with the metabolism of the thyroid. They suggest that in (*a*) ordinary ichthyosis, and in (*b*) the harlequin, there is a deficient or defective thyroid in the infant. In (*a*) this is made up by the thyroid secretion of the mother and therefore no symptoms appear until after weaning, and in (*b*) the mother is unable to supply thyroid so that the child *in utero* develops exaggerated ichthyosis. In other words they believe it is the result of maternal hypothyroidism coincident with an anomaly of the fœtal thyroid resulting in a decrease in its degree of activity. The explanation why this condition and true ichthyosis differ from cretinism lies in the existence of two isomers of thyroidin. The question of isomerism may also explain the fact that many cases do not improve with thyroid treatment.

These, then, are some of the chief theories which have been advanced of late in explanation of some of the problems which this disease suggests. It would obviously be difficult for one on the strength of a single record such as the above to express any very dogmatic opinion on the questions raised. Further, Thibierge and Legrain in their work say that the time is not yet ripe for any clear pronouncement on the matter. Any such decision can only come as the result of the study of a much larger accumulation of the records of individual cases from birth through adolescence to old age. In conclusion I have to thank Mr D. M. Greig for the accompanying photographs.

REFERENCES.—[1] Ballantyne, J. W., *Diseases and Deformities of the Fœtus*, 1895, vol. ii., chaps. 6 to 8. [2] M'Auslin, James T., *Brit. Med. Journ.*, 1921, vol. i., p. 155. [3] Riecke, E., *Arch. f. Derm. u. Syph.*, vol. liv., 1900, p. 289. [4] Riehl, G., *Wien. klin. Woch.*, 1918, vol. xxxi., p. 683. [5] Thibierge, G., and Legrain, P., *Ann. de Derm. et de Syph.*, 1921, 6e serie, tome ii., pp. 289 and 337. [6] Mendes da Costa, *Brit. Journ. of Dermatology*, 1902, vol. xiv., p. 182. [7] Brandweiner, A., *Wien. Med. Presse*, 1906, vol. xlvii., p. 2032, [8] Sequeira, *Brit. Journ. of Dermatology*, 1906, vol. xviii., p. 253. [9] Golay,

Ann. de Derm. et de Syph., 6e serie, tome ii., 1921, p. 97. [10] Thibierge, *Ann. de Derm.*, 4e serie, tome ix., 1898, p. 796. [11] Bowman, A. S., *Med. Journ. Australia. Syd.*, 1918, vol. i., p. 541. [12] Litchfield, W. F., *Med. Journ. Australia, Syd.*, 1918, vol. i., p. 494. [13] Méneau, J., *Ann. de Derm. et de Syph.*, 4e serie, vol. iv., 1903, p. 97. [14] Bruhns, C., *Arch. f. Derm. u. Syph.*, vol. cxiii., 1912, p. 187. [15] Bering, *Arch. f. Derm. u. Syph.*, vol. lxxvi., p. 379. [16] Thomson, M. S., and Wakeley, C. P. G., *Journ. of Obstet. and Gyn. of the British Empire*, vol. xxviii., No. 2, Summer No. 1921, p. 190. [17] Macleod, J. M. H., *Diseases of the Skin*, 1921, pp. 161-169. [18] Renshaw, Gr., *Brit. Med. Journ.*, 23rd April 1921, p. 623. [19] Bowen, J. T., *Journ. of Cut. and Genito-urin. Dis.*, 1895, vol. xiii., p. 485. [20] Wassmuth, A., *Beitr. z. path. anat. u. allg. path.*, 1899, vol. xxvi., p. 19. [21] Winfield and van Cott, *J. Cut. and Genito-urin. Dis.*, 1897, vol. xv., p. 516. [22] Moore and Warfield, *Amer. Journ. of Med. Sci.*, 1906, p. 795. [23] Hess, J. H., and Schultz, O. T., *Amer. Journ. Dis. Children*, 1921, vol. xxi., p. 357. [24] Ballantyne, J. W., *Antenatal Pathology*, "The Fœtus," 1902, p. 306. [25] Jordan, A., *Dermatologische Woch.*, 1922, Bd. 74, pp. 585-592.

THE FATHER OF OVARIOTOMY.*

THE attention of the medical world in Edinburgh has recently been directed, especially by means of the inaugural address of the late President of the Edinburgh Obstetrical Society, Dr William Fordyce, upon the early history of abdominal surgery, and especially upon the person of Ephraim M'Dowell of America, one of its pioneers. It was therefore with more than usual interest that we received from the publishers, Messrs Lippincott, a large volume entitled *Ephraim M'Dowell, Father of Ovariotomy and Founder of Abdominal Surgery.* The book gathers together all the known facts regarding M'Dowell; and its author, August Schachner, has spared neither time nor trouble in order to draw his information from original sources, or to investigate any facts that might shed light, be it ever so little, upon the subject of his biography. The result is a book which, while here and there somewhat pronouncedly American in its prejudices, will still, on account of its completeness and general excellence, undoubtedly rank among the best of medical biographies.

M'Dowell's ancestors emigrated from Scotland to the north of Ireland during the Protectorate of Cromwell, about the middle of the seventeenth century. His great-grandfather, Ephraim, then aged 16, was one of the Scottish-Irish defenders of Londonderry during the siege of that city in 1688, and afterwards, with his two sons and two daughters, emigrated to America, arriving in Pennsylvania in the year 1729, and moving eight years later to Virginia, near to the present town of Lexington. They were among the first settlers in that region, and there, under the British flag, Ephraim, the future ovariotomist, was born on 11th November 1771. He was the ninth of eleven children, and the sixth son. Five years after his birth the Declaration of Independence was signed, and the Revolution was in full swing. In this atmosphere he spent the days of his early boyhood, removing with his family, at the age of 13, to his future home in Danville, Kentucky. Such an environment, coupled with his descent from an unpretentious,

* *Ephraim M'Dowell, Father of Ovariotomy, and Founder of Abdominal Surgery*, with an Appendix on Jane Todd Crawford. By AUGUST SCHACHNER, M.D., F.A.C.S., Louisville, Kentucky. Pp. xviii. + 331. Philadelphia and London: J. B. Lippincott Co. Price 25s. net.

vigorous, and courageous Scottish-Irish stock, no doubt contributed largely towards the development of his self-reliant character.

After spending three years as the pupil of Doctor Alexander Humphreys, a prominent practitioner of Staunton and a graduate of Edinburgh University, M'Dowell attended the University of Edinburgh during the sessions 1793 and 1794. His immediate companion there was Samuel Brown, afterwards the first professor in the New Medical Department of the Transylvania University. Brown on a certain occasion was asked his opinion of M'Dowell, whereupon he is said to have replied, "Doctor M'Dowell went to Edinburgh a goose and returned a gander." Amongst those who attended Edinburgh at the same time was David Hosack of New York, who, on his return to America, became an organiser of Medical Schools, and held the Chair of Botany and Materia Medica in the Columbia College, and later that of Surgery and Midwifery, which in time he relinquished for that of Practice of Physic and Clinical Medicine. Still another companion was John B. Davidson, who afterwards became one of the founders of the University of Maryland. It was through his influence that M'Dowell subsequently received an honorary degree from Maryland University, apparently the only medical qualification that he ever received. During his period at Edinburgh University, business and pleasure were agreeably intermixed, and his summer vacations were spent in pedestrian tours with his companion through the Scottish highlands, visiting those to whom they had letters, and occasionally meeting one or other of their family connections. It is said that when they reached the house of some distinguished person they always hired a conveyance, and driving up in due form and style were received accordingly. They, however, "if their entertainment was to their liking, soon let the cat out of the wallet, immediately upon which all formality ceased, and they were carried about all over the neighbourhood, either on horseback or in a coach, as they happened to fall in with a commoner or gigman, and exhibited to all sorts of people as gentlemen from the extreme backwoods of America."

In his time at Edinburgh he leaned especially towards chemistry at the beginning, and anatomy and surgery towards the end. He had no love for internal medicine, and went so far as to refer to medicine as more of a curse than a blessing to the human race, while surgery he characterised as a "certain

branch of the healing art." Professor Sir A. R. Simpson made a careful study of M'Dowell's movements while in Edinburgh, and incorporated the result in his lectures in the University of Edinburgh in 1887. He found that M'Dowell's name was inscribed in the Roll of Session 1792-93, and opposite his signature the secretary had noted that he had entered to study chemistry. Simpson thinks it probable that in this first session he had studied surgery with John Bell in the Extra-Mural School. In his second session, 1793-94, he entered for the classes of anatomy and surgery under the second Munro; practice of medicine under James Gregory; and botany under James Rutherford, besides the clinical prelections in the Royal Infirmary. It did not take him long to see, however, that anatomy and surgery, if not better taught, were at least more interestingly taught outside the University by John Bell than inside, exalted though the University of Edinburgh stood as a medical centre. It is probable that Bell forcibly depicted the hopeless state of the patient suffering from ovarian tumour and the possibility of relief through surgery. The library records show that during 1793 he had borrowed several books, and amongst them Hamilton's *Female Complaints* and Cullen's *Practice of Physic.*

M'Dowell seems to have left the University without a degree, at that time a not uncommon occurrence as degrees were then of less importance than they are to-day, and the attendance at a college was rather to secure sufficient knowledge to engage in practice than the degree which represented it. In 1795 he left Edinburgh and immediately began the practice of medicine at his home in Danville, at that time a small frontier town containing "upwards of one hundred and fifty homes and some tolerable good buildings." An extensive practice soon sprang up, extending for hundreds of miles around, and as there were no roads nor stage-coaches calls were made on horseback, at times through trackless regions infested by Indians and by wolves. In such a crude, wild, and picturesque setting he performed without trained help all the operations known to the surgery of his day. "He made it a rule not only to study his cases carefully and to prepare them through preliminary treatment, but moreover to rehearse the anatomy and steps of the operation as well as to drill his assistants in the rôles they were to enact."

It is difficult to conceive of a training and of surroundings

more conducive to the development of those qualities of courage and self-reliance which were so conspicuous in his historic operation upon Mrs Jane Todd Crawford.

It was fourteen years after commencing practice, viz., on 13th December 1809, that M'Dowell was called to see Mrs Crawford, who resided sixty miles from Danville. She was forty-six years of age, the mother of five children, and had for a time thought herself pregnant, but as she had far exceeded the usual period M'Dowell was sent for. He found the abdomen so pendulous as to reach almost to her knees, and "she was affected with pains similar to labour pains, from which she could find no relief. So strong was the presumption of her being in the last stage of pregnancy that two physicians who were consulted on her case requested my aid in delivering her. Upon examination per vaginam I found nothing in the uterus, which induced the conclusion that it must be an enlarged ovarium. Having never seen so large a substance extracted, nor heard of an attempt or success attending any operation such as this required, I gave to the unhappy woman information of her dangerous situation. She appeared willing to undergo an experiment, which I promised to perform, if she would come to Danville." This she readily agreed to, and the journey of sixty miles was made on horseback, not without some bruising of the abdominal parietes through the tumour resting upon the horn of the saddle. Having been placed on a table of the ordinary height, and "all her dressing removed which might in any way impede the operation," an incision 9 inches in length was made 3 inches from the rectus muscle on the left side, parallel to the fibres of the muscle and entering the abdominal cavity. The tumour appeared too large to remove entire, so a strong ligature was put round the Fallopian tube near the uterus and the tumour was then cut into, 15 lb. of dirty gelatinous-looking fluid being removed, after which the Fallopian tube was cut through, and the sac weighing $7\frac{1}{2}$ lb. extracted. "As soon as the external opening was made, the intestines rushed out upon the table, and so completely was the abdomen filled by the tumour that they could not be replaced during the operation, a period of about twenty-five minutes."

She was then turned upon the left side to permit blood to escape, after which the external opening was closed with interrupted sutures, leaving out at the lower end of the incision the ligature which surrounded the Fallopian tube.

In five days M'Dowell visited her, and, much to his astonishment, found her engaged in making her bed. He gave her "particular caution for the future," and in twenty-five days she returned home as she came, in good health, which she continued to enjoy. She lived to the age of 78.

M'Dowell thereafter performed ovariotomy in seven cases with only one death (from post-operative peritonitis). In three, however, removal of the tumour was incomplete on account of adhesions.

At various times, upon both sides of the Atlantic, the question has been discussed as to whether the honour of being the first ovariotomist really belonged to M'Dowell. In 1801 Dr Robert Houstoun of Glasgow cured a woman of ovarian dropsy by a large incision made in the left side of the abdomen. In his own report of the case Houstoun states that "with an imposthume lancet" he laid open about an inch, but finding nothing issue he enlarged it to 2 inches, and "even then nothing came forth but a thin yellowish serum," so he ventured to lay it open about 2 inches more. He was not a little startled to find only a glutinous substance stop up so large an aperture, but his great difficulty was to remove it.

"I tried my probe, I endeavoured to do it with my finger, but all in vain. It was so slippery that it eluded every touch of the strongest probe I could take. I wanted in this place almost everything necessary, but bethought myself of a very odd instrument, yet as good as the best because it answered the end. I took a strong fir splinter, and having wrapped some lint about it, I thrust it into the wound, and by turning and winding it drew out above 2 yards length of a substance thicker than jelly or rather like glue that was fresh made and hung out to dry; this was followed by nine full quarts of such matter as I have found in steatomatous and atheromatous tumours with several hydatides of various sizes containing a yellowish serum, the least of them bigger than an orange." Having squeezed out all he could he stitched the wound in three places, placing in the lower part a small tent which "discharged serosities" at every dressing for four or five days. We must pass over Houstoun's description of his dressing the wound with "Lucatellus balsam," and "Napkins dipped in warm French brandy," and his administration of cinnamon water "drawn off from Canary and the best cinnamon," and a diet of "strong broth made of an old cock, in each porringer

whereof was one spoonful of cinnamon water." In four weeks he found her in the fields sitting wrapt up in blankets and giving directions to some labourers who were cutting down her corn.

It is evident from Houstoun's own description that his operation did not entail removal of the cyst, but merely of its contents, through an incision in the abdominal wall. It was, therefore, not an ovariotomy in the sense that M'Dowell's operation was. Strictly speaking, however, the term ovariotomy, better termed oöphorotomy, means cutting into or incising an ovary (or ovarian cyst); while the term ovariectomy or oöphorectomy should be applied to the operation in which the cyst is removed. It is, therefore, literally correct to say that Houstoun was the first ovariotomist but that M'Dowell was the first ovariectomist.

Houstoun's operation of incision and drainage seems to have been considerably adopted, especially in France, though its results were, as a rule, far from satisfactory.

It was not till 1817, *i.e.*, eight years after his operation on Mrs Crawford, that M'Dowell published an account of the case in the *Eclectic Repertory*, along with two other successful cases. This report and another short article constitute his sole contributions to surgical literature.

On the personal side he seems to have been noted for his strength and agility. While at Edinburgh he was selected by his class-fellows to defeat a boastful Irishman in a foot-race over a distance of 60 yards and for a stake of ten guineas. M'Dowell purposely allowed himself to be defeated. A second race was arranged for one hundred guineas, and an increased distance, and in this the Irishman was badly defeated. He possessed a ready wit and a keen sense of humour, and could sing English and Scottish songs with comic effect, accompanying himself upon his violin. In his relations to his immediate professional associates he was moderate and generous to a fault, but this did not prevent him from being made the object of a certain amount of professional jealousy on the part of his colleagues, some of whom spread the impression that when it came to surgery he could be relied upon, but he was "not much in fevers," the animus of which can only be appreciated when we remember the comparative relationship that then existed between surgery and internal medicine. While not a rich man, he was comparatively well-to-do, and, as was the

custom at that time amongst well-to-do families, he possessed a farm which he managed through an overseer, and the breeding of fine horses and swine became with him a special feature. He also kept a few slaves. His fees were good, and in one case he fixed his fee at 500 dollars but is said to have received 1500, "which sum the husband insisted more nearly represented the value of his services."

At the age of 31 he had married Miss Shelby, the daughter of Isaac Shelby, first Governor of Kentucky, then in her 18th year. By her he had six children—two sons and four daughters. Towards the close of his career he purchased a country home about three miles from Danville, where he removed with his family, and from where he could still continue to carry on his practice. To this home he gave the name of Cambuskenneth, after the Abbey of Cambuskenneth, near Stirling, thereby revealing his "fondness for all things Scottish," and the memories of the summer rambles during his Edinburgh student days that remained "the tenderest in his affections."

LETTER FROM VIENNA.

(From our own Correspondent.)

In view of the changed conditions of the time, it may perhaps prove of interest to the English reader if I draw a parallel between the life of a Vienna doctor before and after the war. Let us take as an example a medical man of middle age carrying on a middle-class general practice in one of the outlying districts of the city. From his club practice he would derive an income of 3000 kroner per annum; from his private patients, consisting of officials, teachers, business people, and the like, his average yearly earnings would be 7000 kroner, which at the low fees then prevailing (2 kroner for a consultation, 4 kroner for a visit) meant that he had a busy practice. He is probably married, and has two children; neither he nor his wife have any private means. From this total income of 10,000 kroner his outgoings would be approximately as follows:—His house, with five or six rooms, would have a rental of 2000 to 2500 kroner, or in exceptional circumstances a little more. The monthly wage of a servant was about 30 kroner; for two servants, including New Year presents and insurance premiums, he would certainly not pay more than 1000 kroner. The cost of food varied, but in a family of the middle class might be reckoned at 2 kroner per head per day—say 4500 per annum, so that there remained for clothing, heating, taxes, and amusement, more than 2000 kroner. Thus a doctor in these circumstances lived comfortably enough, and if he were economical, for example, if he kept only one maid-servant, he could save a little from year to year.

Let us now compare with these the present conditions. The same doctor will now get from his clubs 720,000 kroner a year, and his fees for private practice have gone up three hundred fold. Other things being equal, he would now derive from this source 2,100,000 kroner per annum, but in reality this is far from being the case on account of the great increase of sickness insurance among the class who formerly were private patients. Moreover, the number of doctors in Vienna has increased considerably, so that taking one thing with another it may be estimated that his present income from private practice will not exceed 1,500,000, and his total income 2,200,000 kroner. Should he attempt to maintain his former standard of living, his expenses will be as follows:—His rent will have increased ten times—to 25,000 kroner; a half-trained servant cannot be got for less than 6000 kroner a month. The cost of food has gone up by at least a thousand fold, and we must allow 2000 kroner per head per day for that, so that to feed his household of five the doctor requires an income of 3,650,000 kroner. One may say that to live at the pre-war standard a middle-class family such as is referred to must now enjoy an income of 5,000,000 kroner, seeing that

as well as food, clothes, and all the ordinary necessities of life have gone up a thousand fold. Now, no doubt in the days of peace, life in Vienna was luxurious, and it is therefore possible to reduce the standard by a fourth, or even a third, without real hardship. Even so, the doctor with his 2,200,000 kroner falls short of the 3,500,000 needed to maintain the minimal scale of comfort. His family must economise in every direction, not only in giving up all pleasures and luxuries such as tobacco and wine, but in denying themselves some of the real necessities of life. Meat, for instance, will appear at table only twice a week; new clothing is an impossibility; and as a general rule only one room in the house can be warmed. Amusements are out of the question, and the intellectual life is sacrificed by the impossibility of affording books or journals. The example quoted is an average one; the conditions of life may be much harder if the doctor has a smaller income, or a larger family. In such cases only the assistance rendered by foreign colleagues has stood between the doctor and want.

What applies to the general practitioner applies also to the specialist, the fashionable physician, and the University professor. Few people are now able to afford such consultation fees as 5000 to 30,000 kroner while in addition the taxes increase progressively with the income, and most persons in the above positions are liable to the luxury taxes (for keeping more than one servant, and the like).

Those who are best off are the hospital physicians, who, in addition to a modest salary receive board and lodging, in whole or in part, and have not many material cares. But sooner or later they have to give up their posts, and, although they are allowed to marry, no provision is made for the accommodation of their wives and families in the hospitals, so that they generally find it impossible to do so without relinquishing their positions in these institutions.

By their united and confident front the medical profession have twice lately obtained concessions from the government, which are of some value. They now get their telephones at the lowest rate, irrespective of the number of calls, and they have obtained an assurance of adequate representation on the different tax-commissions. Unfortunately, similar promises have been given before, and not adhered to.

The transference of private patients into the ranks of the insured proceeds apace. Very soon all the officials of the city of Vienna will become insured persons.

CRITICAL REVIEW

THE PATHOLOGICAL AND CLINICAL ASPECTS OF DEAF-MUTES.

In an exhaustive study of deaf-mutism, J. S. Fraser[1] passes in review the literature of the subject and records his own experience, including the details of an examination of 140 children in an institution for deaf-mutes.

He classifies cases of deaf-mutism into those due to an error in development (constitutional, developmental, or "congenital" deaf-mutism); and those due to trauma or to inflammatory conditions (acquired or inflammatory deaf-mutism).

Of the developmental or "congenital" forms the writer describes at considerable length a number of types characterised by variations in the clinical manifestations and pathological findings, and reviews the various theories that have been put forward to explain the condition.

Congenital Deafness and Otosclerosis.—In at least seven cases of congenital deafness, a focus of otosclerosis has been found in the labyrinth capsule. Alexander believes that this shows that there is a stepping-stone between congenital deafness and the various forms of congenital hardness of hearing. While the first rudiments of otosclerosis are often of congenital origin, ankylosis of the stapes and atrophy of the sensory epithelium are secondary. Congenital otosclerotic foci may exist without giving rise to symptoms until the age of puberty. Kœrner believes that otosclerosis is due to certain determinants in the germinal cells of the parents, but is influenced by puberty, parturition, the climacteric period, and also by diseases of the middle ear. He explains cases of otosclerosis with no apparent heredity by supposing that the disease has skipped some generations. Manasse has shown that the nerve changes are the same in advanced otosclerosis and in pure nerve deafness. Further, we know that there are cases of atypical otosclerosis in which functional examination apparently shows pure nerve deafness. Gœrke apparently believes that the focus of pathological bone in otosclerosis is only incidental and not of great importance. Stein is of opinion that in otosclerotics there are always other diseases of degenerative origin, while Hammerschlag reminds us that there are families in which cases both of hereditary deafness and otosclerosis are to be found. These facts suggest that hereditary deafness and otosclerosis are to be regarded as different forms of one and the same pathological process.

Deaf-mutism associated with Changes in the Brain — Castex has stated that in his experience deaf-mutism is usually due to changes in the cortical hearing area and much less often to changes in the ear. He believes that the cortical changes are due to meningitis which is sometimes intra-uterine. Brock comes to the conclusion that we must give up the view that in all cases of deaf-mutism the explanation is to be found in malformation or disease of the ear, though he admits that the deafness may be explained by alterations in the sensory hair cells too fine to be recognised by the microscope. The question of deafness due to brain lesions is a very difficult one. Microscopic examination of the hearing tracts and centres requires great experience for the proper interpretation of the appearances presented by the different layers of the cortical hearing centre. The otologist, who examines the labyrinth, should work in conjunction with a neuro-histologist.

Acquired or Inflammatory Deaf-mutism.

The pathology of acquired or inflammatory deaf-mutism is a comparatively simple problem. It is the *pathology of labyrinthitis occurring in intra-uterine or post-fœtal life.* Intra-uterine labyrinthitis is almost certainly of meningitic origin. Post-fœtal labyrinthitis, on the other hand, may be due to traumatism, as in fracture of the cranial base, to otitis media with invasion of the labyrinth through the oval or round windows or through the prominence of the lateral semi-circular canal; or to purulent leptomeningitis with infection of the inner ear either along the fibres of the eighth nerve or along the aqueduct of the cochlea. It may, however, be difficult or impossible to determine by microscopic examination—many years after the occurrence of deafness—the exact route of infection of the labyrinth. (The writer records with photomicrographs a case of inflammatory or acquired deaf-mutism, *i.e.*, spontaneous cure of labyrinthitis which may have resulted from purulent otitis media or, more probably, from meningitis possibly of intra-uterine origin.)

Deaf-mutism due to Trauma follows fracture of the cranial base, which involves the labyrinth on both sides. About 4 per cent. of cases of acquired deaf-mutism are of traumatic origin. Microscopic examination may show traces of old fracture of the petrous bone. The semi-circular canals are almost filled up with new bone: the perilymphatic space of the vestibule greatly reduced by new bone and connective tissue. The utricle and saccule are dilated. The cochlea shows new formed bone and connective tissue in the perilymphatic space, great dilatation of the cochlear duct, and atrophic degeneration of the neuro-epithelium and spiral ganglion.

Deaf-mutism due to Labyrinthitis following Middle-Ear Suppuration.

—Middle-ear lesions alone do not as a rule produce such severe deafness as to give rise to deaf-mutism, but closure of both labyrinth windows may produce deaf-mutism even when the inner ear is intact. In deaf-mutism due to *scarlatinal otitis media and interna*, there is great destruction of the middle ear. The drumhead and ossicles are usually absent, while cholesteatoma is present with caries and necrosis of the bony walls of the middle ear. The labyrinth may show chronic suppurative labyrinthitis, new connective tissue and bone formation, or the hollow spaces may be filled with cholesteatoma, which has passed in through the open oval window. Much the same changes are present in cases of *deaf-mutism due to measles*. Siebenmann states that *tuberculous* middle-ear disease may destroy the bone extensively and yet may finally heal up, with resulting deaf-mutism. In regard to "*congenital*" *syphilitic deafness*, there are two views as to the nature of the pathological changes. Some observers hold that the deafness is due to syphilitic meningitis and secondary neuro-labyrinthitis, while others believe that it is secondary to otitis media which, in syphilitic children, does not clear up but breaks through the windows or invades the bony capsule of the labyrinth and so reaches the hollow spaces of the inner ear. In support of the latter view, cases have been reported by Moos and Steinbrügge, Gradenigo and the writer.

Deaf-mutism due to Labyrinthitis following Purulent Meningitis.—The meningitis may occur either during intra-uterine or post-fœtal life. Post-fœtal meningitis may be due to epidemic cerebro-spinal meningitis, measles, pneumonia, scarlet fever, influenza, etc. The inflammatory process begins in the perilymphatic space with hyperæmia, stasis, thrombosis, and rupture of the smaller vessels. This is followed by infiltration and necrosis of the endosteum. The blood supply from the endosteum is cut off, and this leads to necrosis of the sensory epithelium with curdling of the endolymph. The eighth nerve is embedded in pus. Later on the labyrinthine fluid becomes purulent, with complete destruction of the membranous labyrinth. This stage results in the formation of granulation and connective tissue. Lastly, there is new bone formation. The round window membrane is thickened and ossified, while the footplate of the stapes may be displaced towards the tympanic cavity. At least six cases of deaf-mutism apparently due to labyrinthitis caused by intra-uterine meningitis are on record. For obvious reasons it is impossible to prove this with certainty.

Post-fœtal meningitis is the most frequent cause of **acquired deaf-mutism.** The majority of cases are due to *epidemic meningitis.* An almost abortive form of meningitis may lead to severe changes in the inner ear and consequent deafness. In deaf-mutism of meningitic origin there are marked changes in the labyrinth and

relatively slight changes in the middle ear, whereas in deaf-mutism of tympanic origin there are gross changes in the middle ear and less marked changes in the labyrinth. In meningitic cases the most marked changes are found in the cochlea and canals. In most cases there is ankylosis of the stapes and bony closure of the round window. Investigation of the central nervous system has shown chronic internal hydrocephalus in some instances. Reimer observed meningitis in fifteen out of fifty-one autopsies on cases of *measles*. Nager has recorded the case of a boy who became deaf at three years. He was slow in regaining the power of walking, probably owing to changes in the maculæ of the saccule and utricle. Examination showed dilatation of the membranous labyrinth, destruction of Corti's organ, atrophy of the spiral ganglion and nerve fibres. In most cases of *post-scarlatinal* deaf-mutism the drumheads are normal, while some of the patients show weakness of intellect, just as after other forms of meningitis. "*Congenital*" *Syphilis*.—Otto Mayer has examined the ears of eleven syphilitic infants who died at periods varying from ten minutes to seventeen months after birth and found evidence of inflammatory changes in the pia arachnoid in ten. Lymphocytic infiltration was present along the trunk of the eighth nerve, especially marked at the fundus of the internal meatus. The meningitis could be traced to the spiral ganglion in the basal coil. Corti's organ showed similar changes. There was also meningitic infiltration along the aqueduct of the cochlea. Mayer believes that "congenital" syphilitic deafness is probably due to an extension of syphilitic meningitis along the acoustic nerve. *Meningitic Labyrinthitis due to Osteomyelitis and Mumps*. The appearances described by Steinbrügge in a case of deaf-mutism due to osteomyelitis correspond to those observed in healed cases of meningitic neuro-labyrinthitis. Siebenmann states that the pathology of deafness after mumps is of a similar nature, but others hold that it is due to infective embolism.

Clinical Examination of Deaf-mutes.

The classification of a given case of deaf-mutism as either "congenital" or "acquired" might appear to be a comparatively easy matter. No doubt if we could always obtain an accurate history of the case from the child's parents or doctor, the question of correct classification would be greatly simplified. Further, if we always obtained typical functional results for each given group of cases, *e.g.*, if a "developmental" case invariably had some remains of hearing and normal vestibular reactions, or if an "inflammatory" case always occurred after speech had been acquired and resulted in complete deafness and absence of response to rotation and caloric tests, it would be a simple matter to divide a number of deaf-mutes into their

proper categories. The fact is, however, that we have to depend very largely on the statements of the child's parents—statements which are frequently quite unreliable—and on the hearing and vestibular tests, which are often ambiguous or difficult to carry out. Otoscopic examination is by no means a reliable guide. The fact that a child is suffering from chronic middle-ear suppuration does not prove that the deaf-mutism has been caused by labyrinthitis of tympanic origin. A child born with a congenital abnormality of the cochlea and saccule may suffer from middle-ear suppuration. The first case recorded by the writer was a "congenital" deaf-mute who died as a result of an intracranial complication and middle-ear suppuration. On the other hand, the fœtus may suffer from meningitis *in utero*, or the infant may have a meningitic labyrinthitis before speech has begun to develop. Such cases would probably be regarded by the parents as instances of congenital deaf-mutism, whereas in reality the hearing defect was acquired. The second of the writer's cases was looked upon by the boy's mother as one of congenital deafness, but microscopic examination showed that the cause of the deaf-mutism was bilateral labyrinthitis of tympanic or meningitic origin.

Nager points out that in congenital deaf-mutism the *sexes* are nearly equal, but in acquired cases the boys greatly outnumber the girls. He suggests that boys may suffer more from fever than girls.

Hammerschlag finds that in cases in which there was only one deaf-mute in a family the marriage was *consanguineous* in 14 per cent.; in cases with two deaf-mutes, 22 per cent.; with three or more, 55 per cent. Apparently about 12 per cent. of deaf-mutes have parents who were related before marriage.

Nager points out that direct *heredity* is rare and that only one out of a hundred deaf-mutes had deaf-mute parents. On the other hand, if both parents are deaf-mutes from birth, 26 per cent. of their children are deaf-mute.

If we gather together the statistics compiled by various observers, we obtain a percentage of 52 congenital cases, 43 acquired and 5 doubtful. The percentage of cases in each group depends upon the region investigated. In Switzerland, for example, there are many more congenital than acquired cases, on account of the presence of endemic cretinism.

If we again assemble the figures given by various writers, it appears that of each 100 cases of "acquired" deaf-mutism, 36 were due to epidemic meningitis, 16 to scarlet fever, 10 to measles, 10 to pneumonia, 11 to syphilis, 4 to trauma, 3 each to whooping-cough, mumps, and typhoid fever, and 2 each to influenza and pneumonia.

According to the findings of different investigators the percentage of cases of deaf-mutism attributed to *congenital syphilis* varies from 2.5

to 18.6. The higher figures are obtained by the Wassermann reaction. According to Kerr Love and Browning, even this reaction does not discover all cases of congenital syphilis, *i.e.*, a negative reaction cannot be taken as complete proof that syphilis is not the cause of deafness.

Functional Examination of Deaf-mutes. *Cochlear Apparatus.*—Itard's clinical classification of deaf-mutism is as follows: Group I. Coversation voice heard at 6 ft. II. Raised voice heard close to ear. III. Vowel hearing. IV. Loud noises heard, *e.g.*, rattle, trumpet, whistle, or hand-clapping. V. Total deafness. Class V. can be excluded as early as six months, provided that the infants are otherwise mentally normal. Group III. can only be satisfactorily examined at the age of two years and Groups I. and II. at the age of four to five years. Alexander calls attention to the fact that the totally deaf drag their feet because they cannot hear the unpleasant sound thus produced. From figures given by various observers it appears that from 25 to 40 per cent. of deaf-mute cases are totally deaf. Schmeigelow remarks that the percentage varies according to the method employed in testing the children. From 25 to 30 per cent. of deaf-mutes have hearing remains sufficient to be of some use for education.

Vestibular Apparatus.—Alexander states that in cases of deaf-mutism in which the history is doubtful, we can assume that the case is congenital if the static labyrinth is excitable. Frey and Hammerschlag employed the rotation test and found that in acquired cases 15 per cent. showed a positive vestibular reaction, 81 per cent. were negative, and 4 per cent. doubtful. In congenital cases, on the other hand, 71 per cent. were positive, 24 per cent. negative, and 5 per cent. doubtful. Pollak has examined the galvanic reaction and found that in congenital cases 86 per cent. had normal and 14 per cent. had absent reaction. In acquired deaf-mutism, 71 per cent. had absent and 29 per cent. had normal galvanic reaction.

REFERENCE.—[1] *Journal of Laryngology and Otology*, January to March, 1922. (A full bibliography is appended to the original paper.)

OBITUARY

THE LATE SIR JAMES O. AFFLECK

By the death on 24th September of Sir James Affleck, there has been lost to Edinburgh one who occupied an almost unique place in the medical profession. He was never prominent in public life, nor had he a prolific pen, yet in virtue of his personality and professional eminence his name was familiar, as it was respected, throughout Scotland, and his influence made itself felt far beyond the immediate sphere of practice.

James Ormiston Affleck was born in Stockbridge in 1840; he and an elder brother resolved as youths to study medicine, and in order to do so they found it necessary to work for some years in an accountant's office. It is difficult to conceive that Affleck could ever have found accounting congenial. He thus did not graduate as early as those more fortunately circumstanced, for he was twenty-seven when he took his degree. His brother, to whom he was deeply attached and of whose talents he always spoke with touching admiration, died of tuberculosis soon after qualifying. In his student days Affleck had the good fortune to attract the notice of Sir Douglas Maclagan, and there sprang up a friendship between the two men which was deep and lasting. After completing a term as House Physician in the old Royal Infirmary, he became Maclagan's assistant in the department of Medical Jurisprudence, and in after life he was wont to speak of the benefit which he had derived from the training in chemical investigations carried on in Maclagan's laboratory. At the same time he began general practice, first in a house in Clarence Street, and a few years later in Henderson Row. Among his early appointments were those of Physician to the New Town Dispensary, with the added post of public vaccinator to bring in some grist to the mill. About this time also he became busily engaged on the medical articles in the Ninth Edition of the *Encyclopædia Britannica*, and the claims of an ever-growing general and obstetric practice were becoming more insistent. In 1870 he was appointed Assistant Physician (with charge of fever wards) to the Royal Infirmary, and began the Lectures on the Practice of Physic in Surgeons' Hall, which he continued with unvarying success until he retired from the teaching staff of the Infirmary

thirty years later. In 1869 he became a Fellow of the Royal College of Surgeons, not because surgery had any attractions (though he would often assert with a smile, "Yes, I am entitled to use the knife"), but in order to render himself eligible for office in the New Town Dispensary. He was not elected a Fellow of the College of Physicians till 1875. He became a full physician to the Infirmary in 1885, and about the same time removed to Heriot Row. In these days the junior ordinary physician had only one (female) ward, and Affleck's first years of clinical teaching were spent in ward 30. Not until the retiral of Claud Muirhead, in 1891, did he have charge of a ward and a half. On the completion of his term of service (in 1900) he retired; but his connection with the Infirmary was not severed, for, until a year or two before his death, he was an active and influential member of the Board of Managers. Although so great a part of his life's work was done in the Infirmary, the welfare of the Longmore Hospital for Incurables, the foundation of which he had taken an active part in promoting, was very near his heart; from its opening he was Physician and a Director, and only four days before his death he paid his usual weekly visit to its wards. On his retiral from the Infirmary he was appointed Consulting Physician to the City Fever Hospital, and thus for a few years longer continued actively in touch with clinical teaching. During his whole career as an Extra-mural Lecturer he maintained cordial and intimate relations with the University, and acted for more than one term as extern examiner in medicine and clinical medicine. He was a member of the Board of Management of the Royal Asylum for the Insane, and of the Sick Children's Hospital; he was Consulting Physician to the Maternity Hospital, and (1905-1907) occupied the Presidential Chair of the Medico-Chirurgical Society. In 1908 his Alma Mater conferred on him the honorary degree of LL.D., and in 1911 he received the honour of knighthood.

Affleck was pre-eminently a good clinician, and on this, not on any gift of exposition, nor on any specially happy endowment of manner, did his great success as a teacher and his well-deserved reputation as a consultant primarily depend. He had the benefit of a very large experience of all classes of disease, and was an extremely accurate observer. Like many other good diagnosticians, he had a great faculty for appreciating the significant features in an obscure case, and refused to be side-

tracked by unimportant symptoms. Diagnosis with him was more a matter of detecting some sign which he knew to be important or pathognomonic than of considering and balancing probabilities. He had a wonderful gift for recognising ominous signs in acute disease, and his prognosis in this class of case was seldom far astray. As a hospital physician he never missed a day, Sundays included, but he seldom made a lengthy ward visit; most often his first examination of a patient was made at his clinique, but in a rapid walk from bed to bed he found out everything that was important about the patients, in a way that was instructive, though sometimes humiliating, to his house physicians. As a ward teacher he was uniformly successful, and always had a large following; he exacted a high standard of work from his students, and his praise, as it was scantily given, was the more appreciated by them. Many of his more formal clinical lectures—in fifteen years he never lectured twice on the same subject—were models of their kind, and it was always a matter of regret that none of them were published, and that all that remains of his teaching is the tradition he handed down to his numerous pupils. During his active period in the Infirmary it was the fashion to discourage excessive therapeutic zeal—in his own words, to "avoid the *nimia diligentia medicinæ*" —but although Affleck's treatment was simple, he was fertile in resource, and it was seldom that he had not some practical suggestion as to a remedy. At a time when physicians in general were tardy in appreciating the possibilities of abdominal surgery, Affleck both taught and practised co-operation between the surgeon and physician. The late Mr John Duncan was a frequent visitor to his wards, and some of the first operations for appendicitis in Edinburgh were performed on his patients. He was in no sense a specialist in one branch of medicine, and his students got from him an all round knowledge of disease, conveyed largely in pregnant generalisations. The only group of maladies in which he seemed to take little interest were nervous diseases; the minute anatomical diagnosis of lesions which was in vogue in the nineties did not appeal to his practical mind. He always insisted on the importance of studying the natural history of disease at the bedside, for he regarded any deviation from the ordinary course as of great prognostic significance, and it is doubtful whether he would completely have concurred

in the modern conception of the approach to disease from the physiological standpoint. Until quite late in life he was wonderfully receptive of new methods of diagnosis and treatment, and had an unerring *flair* for such as would stand the test of time.

The great value of his services to the Infirmary and other institutions as a manager resulted less from any special administrative capacity than from his sagacious judgment and his large experience as a hospital physician. Perhaps his chief interest lay in the welfare and efficiency of the nursing staff, and the good name and status of the nursing profession were his constant solicitude. As the years went on there naturally devolved on him considerable responsibility, both direct and indirect, in connection with hospital and other appointments in Edinburgh; his backing was much sought after, and was given conscientiously, without reference to personal considerations, solely on grounds of merit.

His success as a consultant was contributed to by his both feeling, and being able to convey, genuine sympathy for suffering and anxiety. Moreover, although he never treated a serious case with an optimism he did not feel, he always, no matter how bad things looked, had some message of hope or comfort for the patient, while his resourcefulness in treatment helped him to relieve much suffering. Few things gave him greater pleasure than the constant demands made on him by his colleagues in cases of personal illness. He was truly the doctors' physician.

Affleck was a lifelong supporter of the temperance cause, a Free Churchman, and a Victorian Liberal. The dominating notes in his character were a sincere piety, strong convictions, and a reserve which often amounted to shyness. A puritan by nature, he had no taste for ceremonial, for social functions, or for conviviality, and for this and other reasons he never accepted the Presidential Chair of the College of Physicians, although for many years he was a member of Council, and took a leading part in the College's affairs. To those who did not know him intimately, his habitually grave demeanour and his ignorance of the pursuits and hobbies of the average man may have concealed the fact that he had in reality found the secret of happiness as few have done. By his concentration on a calling for which he had great aptitude, and his singleness of purpose, he gave to life more than he asked of it, and as its creditor had

2676

Photo by] [*A. Swan Watson.*

SIR JAMES ORMISTON AFFLECK, M.D.

the better bargain. It is easy to translate *de mortuis* into fulsome praise, and there is nothing he more abhorred; but it is literally true to say that he never refused an appeal, personal or otherwise, to his charity. He was always on the side of the bottom dog, and when his judgment was warped, it was generally on behalf of a lost cause. The number of those he helped out of difficulty will never be known. To his patients he was the beloved physician.

To his friends there was gradually revealed the hidden side of his character. A fluent talker when once his reticence was forgotten, he could discourse for long on the places he had seen (for travel was his great recreation), on people he had met, on his teachers and their ways, on bygone medical politics, on the problems of medicine, on the puzzles of life. He was well read in the classics and the moderns, and it must have been diffidence and lack of leisure that prevented him from writing more, because composition was no effort to him. He drew a great deal of pleasure from the fact that by his advice he was able to help so many people in their private troubles, that he was the recipient of many confidences, and that he was *au fait* with whatever was going on in his world; it was only in the sense that he felt influence slipping from him that he regretted the passage of years. He had a great deal of quiet, childlike humour and a keen sense of the ludicrous. He took a very human pleasure in the many friends he had made in all ranks of life, in the trusted position he had acquired, in his knighthood, in his LL.D. degree. His religion was a part of the man; he never talked about it, but his innate goodness was a thing that could not be hidden. He had his likes and dislikes, but his dislikes were never ill wishes; he would, and could without affectation, say that he had nothing but friendly feelings to all men.

Sir James Affleck was unmarried. An elder sister was his devoted companion, and he was never quite the same man after her death in 1913. He had suffered from cardiac symptoms for about eighteen months, but treated them lightly, and was never laid aside by them from work. He passed away peacefully in his sleep on Sunday morning, 24th September. It was as he would have wished it to be.

J. S. F.

SCOTTISH SOCIETY OF ANÆSTHETISTS

An Ordinary Meeting of the Society was held on 15th April in the rooms of the Medico-Chirurgical Society, Aberdeen,—President, Dr Johnston, in the Chair.

Dr Ogston in a paper entitled **"Notes on the Administration of Ether by the Perhalation Method,"** pointed out that this system now replaces chloroform as the stock method for abdominal surgery, and that the standard which it has to meet is therefore a high one in respect of abdominal relaxation and quiet respiration. If the points referred to later are attended to, there is no difficulty in reaching the required standard. To be effective as an inducing agent, as much as 18 per cent. or more of ether vapour is necessary, whereas when given on the ordinary mask Hewitt and Syme have shown that not more than 14 per cent. is available. As much or possibly more ether is vaporised by expiration than by inspiration. By a simple device, Dr Ogston demonstrated to the audience that ether vapour does not rise in an appreciable quantity more than half an inch above the mask, whereas it is easily detected by touch, smell, and sight many inches below it. The apparatus used by him provides for the conservation of this ether vapour of expiration. It consists of an ordinary Bellamy Gardner mask, upon which is erected a secondary frame composed of six uprights, joined at their distal extremities by a metal ring; a towel pinned round the uprights furnishes a cylinder, at the bottom of which the ether vapour collects. The aperture is as wide at the top as at the bottom, so that all the gauze is available for the reception of drops of ether. Personally, he prefers to keep the head in the mesial position even during deep anæsthesia, so that the apparatus is suitable both for induction and maintenance. Some twelve to sixteen layers of gauze are used on the mask itself and great care exercised as to the fit between face and face-piece. Another point on which he lays great emphasis is the even distribution of the ether. If all drops fall in one spot, freezing takes place and the ether percentage is lowered. Dropping must, of course, be continuous. In favourable cases, induction takes six to ten minutes. With the use of the cylinder, the temperature in front of the mask does not fall below 50° or 60° F. After anæsthesia is established and less ether is being used, the temperature within the cylinder rises to 70° or over. The economy of ether is such that over-dosage is quite possible. No doubt there is also some concentration of Co_2, but rarely of such a degree as to do any harm. Occasionally one sees shallow breathing and duskiness which might be attributable to this cause. Such symptoms pass away at once if the mask is withdrawn

for a few respirations and is turned upside down, to empty the gaseous contents of the cylinder. A free air-way is essential. He believes greatly in Hewitt's air-way; when necessary he even puts a gag or prop between the teeth before beginning induction. He believes in going very slowly at first. This really saves time in the end, as it causes less mucous and respiratory embarrassment. In order to secure this result, he often starts with the apparatus upside down, having the aperture of the cone adapted to the face and dropping the ether upon the inside of the mask. Before the operation is started he abolishes the corneal reflex and obtains medium dilatation of pupils. Later, he allows the corneal reflex to reappear. He regards sighing as rather a favourable sign, showing sufficiently deep anæsthesia. Moaning he considers indicates too deep a level.

Dr J. S. Ross thought the method really provided for induction in even powerful subjects by ether alone. Personally he used a little chloroform, not more than a drachm, during the induction stage. He asked how much ether Dr Ogston used, and whether he had formed any impression as to ethanesal.

Dr Lamb thought induction by ether alone was rather slow. Moaning he considered indicated a light, not a deep anæsthesia.

Dr Barras doubted whether corneal reflex was very valuable if morphia had been given.

Dr Fairlie preferred the lateral posture for the head when deep anæsthesia had been obtained; otherwise he agreed with most of Dr Ogston's views.

Dr Frew was interested in the simple design of Ogston's apparatus. He had tried a towel in front of the mask to condense the vapour, but without much success, and had adopted the apparatus described some time ago by Picton, which had the advantage of maintaining a somewhat higher temperature of the inspired air than does the ordinary method.

Mr G. H. Colt thanked the Society for inviting a surgeon to attend. He drew attention to the difference between open ether given by the expert to a prepared patient, and by the novice to a patient who had not had morphia and atropin, the latter condition being one of the drawbacks of the method in out-patient practice, notably in the reduction of fractures. The expert anæsthetist rendered the performance of difficult operations comparatively easy. He suggested that some form of muscle tonometer might be an advantage during the different stages of an operation, especially for teaching purposes.

The President thanked Dr Ogston for his valuable contribution and gave personal testimony to the great success of the method. He

believed that to those who had not made use of some such assistance to the ordinary open ether method, the facility with which Dr Ogston induced by the use of his method would be a great surprise.

Dr Ogston, in replying to questions, stated that he used 1½ oz. to 2 oz. of ether for the induction, and completed the first half hour, as a rule, by 4 oz. including the induction stage. These quantities are for average cases: in debilitated cases as little as 1 oz. may suffice for induction, while in robust alcoholics as much as 2 or 3 oz. may be required. He had tried ethanesal but did not now use it.

Dr Holme Henderson in a paper entitled "**Some Considerations on Gas and Oxygen**," said that this combination had as yet been little used for prolonged anæsthesia on this side of the Atlantic, and few of us had sufficiently long experience to enable us to speak didactically. From America, however, we had such statistics as those of Lakeside Hospital, Cleveland, in which Teter and his assistants had given 34,964 administrations without a fatality. Statistics, as a rule, had value to a coroner only. They left out the personal factor. The general public believe that of all anæsthetics nitrous-oxide and oxygen has the smallest mortality, but this belief is not necessarily correct. As regards their administration, there could be no question but that long administration with the older apparatus often led to very alarming symptoms, such as pallor and faint breathing, which might or might not be due to the condition now recognised as acapnia. The modern apparatus provided for complete control of the flow of gases and of their relative proportions, and provided for re-breathing. This has made an immense difference, and by the use of such plant beautiful results could be obtained. There was, perhaps, in America, however, a tendency to place too much reliance upon mere mechanical perfection. One read accounts of one lady, not possessed of a medical qualification, looking after six patients to whose faces the mask had been attached, but one must receive such stories with caution. At the same time, he did not wish to throw any doubt upon the accuracy of American figures. Evidently, their results were obtained with a degree of brilliance which did not appear to be easily attained in this country. One could only suppose that there were some factors different in the two countries. He thought the American subject was more open to the power of suggestion, and possibly less addicted to the use of alcohol, which made him a better subject for anæsthesia. He thought we should be wise not to spoil the case for nitrous-oxide and oxygen by over-rating its claims or under-estimating its possible dangers. The main object of his paper was to urge members of the Society to record their own impressions of the method, and in doing so to indicate their views upon the most appropriate drugs and dosage for preliminary medication, and the combination of other adjuvant anæsthetics during

the operation. Such aids to nitrous-oxide and oxygen were undoubtedly necessary, as the anæsthesia by the gases themselves was of a very light degree. No account of administrations was of any value unless these helps were clearly recorded. So far as the general public is concerned, he thought they should be made to grasp clearly this point —that while nitrous-oxide and oxygen is the safest of all anæsthetics in the hands of an expert in the technique of its administration, it is perhaps the most unsafe in the hands of the inexperienced, and that it should, therefore, never be administered except by an anæsthetist specially trained in its use. It is interesting to learn that the first gas-oxygen administrator at the Lakeside Hospital had to become proficient in anæsthetising dogs by the method before being allowed to use it on the human subject.

In his own experience, he had found that it was no use working with anything but a first-class machine, which gave real control of the two gases and of any auxiliary anæsthetics. The one that he used was as versatile as any: it was the Gallagher Model, U.S. Army. Previously, he used a small model U.S.A. Gawthmey machine, and though quite pleased with it he saw that the other had some additional advantages. He was sure that the time is not far off when the anæsthetist dare not run the risk of having no means to give gas oxygen when called on, and he thought, therefore, it was wise to have a spare apparatus in reserve. It is necessary to understand every detail of the mechanism one is using.

As to class of case, he had used it for all branches of surgery, even in eye work—extractions, iridectomies, etc.—and he had found it very satisfactory. In abdominal work, undoubtedly it was the severely toxic cases in which the advantages of the method were most marked. From experience in such difficult cases as gall-bladder operations and removal of the prostate, he had formed the conclusion that any case might be done under gas oxygen if it were absolutely necessary.

The President thanked Dr Henderson for a most interesting paper, and suggested that a précis of the paper be circulated to the members, and a discussion on it put upon the Agenda for the Autumn Meeting.

NEW BOOK

Artificial Limbs and Amputation Stumps. By E. Muirhead Little, F.R.C.S., Consulting Surgeon to the Royal National Orthopædic Hospital, Visiting Surgeon, Queen Mary's Convalescent Hospital at Roehampton: with 267 illustrations. London: H. K. Lewis & Co., Ltd. Price 18s. net.

The great war has opened up the whole question of the relation of amputation stumps to artificial limbs by affording to many surgeons an experience in artificial limb fitting which was never possible to any before. Among these surgeons Mr Muirhead Little deservedly stands very high. About 25,000 cases of amputation have been supplied with artificial limbs at Roehamption, the majority of which have passed through his hands. Moreover, as Adviser on Artificial Limbs to the Ministry of Pensions, he has had the opportunity of considering every detail of construction of artificial limbs and has been consulted regarding the relative merits of innumerable suggestions for improvement. His object in this book is to pass on to others the knowledge which he has gained about stumps in relation to artificial limbs, as well as to explain the structure and indicate the relative value of the various forms of artificial limbs themselves.

The history of artificial limb fitting is by no means extensive, but it is instructive to find that some of the mechanical devices brought forward recently, especially for artificial arms, had been invented many years ago by the late Comte de Beaufort and apparently forgotten. A subject which concerns both surgeons and limbmakers is "The relations between the natural joints and those of prostheses." This involves an explanation of how the natural joints move, how they can to some extent be replaced by artificial joints, and where and how these artificial joints should be placed when the various items of the artificial leg are being "assembled." All this is carefully considered by Mr Muirhead Little, and cannot fail to contribute largely to the efficiency of artificial limbs in future. In the chapter on "Provisional prostheses" the author mentions several kinds of provisional peg leg. As this is an appliance which is useful in civil practice, it seems advisable that in a future edition a description of how to make the plaster pylon and other simple varieties of this type of artificial limb should be introduced. In the section on arm prostheses reference is made to the mechanism by which one or more portions of the artificial limb are put under control by cords tightened from some other part of the patient's body, and the kinds of remunerative work that are made possible to the maimed man by the skill and ingenuity of the limbmaker are indicated. The British Official Arm Prostheses are

described, and their value as aids for work are indicated. Perhaps even more might have been said on this subject for the benefit of men maimed in civil life. The great value of the upper limb to mankind is manifested very painfully if both hands and arms are lost. As the result of the war a considerable number of men have lost both hands and parts of the arms; a few have lost both upper extremities entirely: this leaves them in many respects helpless, and the various means by which men suffering from such mutilations are enabled to do something for themselves are indicated. Among these is a very ingenious machine controlled by the feet which has been invented by Mr George Thomson of Edinburgh for enabling men to feed themselves, play draughts, light a cigarette, and in other ways do things for themselves which without it would be impossible. When only the hands have been lost much has been done by the sufferers themselves in the past to make up for their loss. Some of their ingenious devices are recorded, but by no means all, and perhaps at some future date more of these devices may be collected.

From the time when artificial limbs were first called for in the late war, a steady effort has been made to improve their material, design, and mode of construction. At first the various limb-makers held on to the patterns they were familiar with, but by degrees the best patterns and the most suitable materials were recognised, and now there is a list of patterns turned out by different makers which alone are recognised as official, while a smaller list of "Standard patterns" for a few common sites of amputation is compulsory on all the makers for the Ministry of Pensions.

So far we have avoided reference to any controversial questions. As may be expected, however, such questions do crop up in the book and some of them have an important practical bearing on the welfare of patients who require amputation. Mr Little does not formally condemn Chopart's amputation, but he alludes to objections to it in a way that would discourage young surgeons from adopting it. He calls attention, for instance, to the possible drawing up of the heel by the gastrocnemius and soleus, but does not mention how easy it is to obviate this trouble by dividing the tendo Achillis at the operation. Again, he points to the heavy and clumsy artificial limb made for stumps by several limb-makers, but he does not suggest, as he well might, that this old type of limb should be discarded in favour of the lighter, simpler, and cheaper appliances worn with an ordinary boot, which is now made by the Rowley and the Ferris firms and is figured in his book.

Amputations in the neighbourhood of the knee-joint have been under discussion for some time, and opinions regarding their usefulness still differ. The short below-knee stump of, say 2 to 3 inches,

taking its bearing on the bent knee has given excellent results at Edenhall, the fitting centre for the East of Scotland. Mr Little, however, disparages the operation, and gives as a reason "that the patella and anterior surface of the knee and top of the tibia are not naturally weight-bearing surfaces." He does not, however, employ the same arguments against "below-knee" and "mid-thigh" amputations, where he advocates weight-bearing on surfaces which have no pretence at all to have natural weight-bearing surfaces. Apart from theory, however, the results obtained from this amputation justify its continued adoption.

Mr Little refers more than once to the stump after disarticulation at the knee-joint in relation to an artificial limb, but has apparently not made up his mind about it. Thus, on p. 29, he says: "British surgeons and makers of artificial limbs are agreed in the conclusion that except in the case of the hip and shoulder, where there is no choice, disarticulations do not provide satisfactory stumps;" on p. 31, however, while still referring to this form of stump, he says: "It may be assumed that in military practice about 36 per cent. of cases are suitable," and adds, "In civil practice a very much larger proportion of cases may be expected to be fit to use end bearings," *i.e.*, to be provided with satisfactory stumps. Another objection to this amputation mentioned by Mr Little on p. 29, is that the artificial limb adapted to it requires jointed side steels which render the artificial limb wider than the normal limb. This objection would tell equally against all "below-knee" stumps, but no one thinks of raising it against them. The publishers' share in the work has been excellently carried out.

Mr Muirhead Little is to be congratulated in having carried through a difficult task with great success.

NEW EDITION

Œdema and Nephritis. By MARTIN H. FISCHER. Third Edition. Pp. xvi + 922. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1921.

The problems of œdema and nephritis loom large in the field of clinical medicine, and the theories that have been put forward to explain the conditions have been almost as numerous as the researchers who have dealt with the subject. The present volume has the unique character of consisting almost entirely of the observations and conclusions of one man and his fellow-workers. The thesis in short is that œdema is a production of cellular acidosis and that nephritis

is but part of this general condition. The author deals first with the physico-chemical conditions of colloids, and has outlined some very striking experiments *in vitro* from which he draws analogies between the absorption and holding of water by colloids in these *in vitro* experiments and the absorption and retention of water by the tissues. It is but a natural step to investigate the causes of abnormal swelling of the cells, and he proceeds to demonstrate that all œdema is preceded by a local or general acidosis. The evidence, both experimental and clinical, which he brings forward to substantiate that hypothesis makes it attractive and almost convincing. Continuing, he takes up the question of absorption and secretion of water by the organism as a whole, and the problems of water-balance, and gives a short outline of urinary secretion and abnormal diuresis demonstrating the physiological variations and control of the circulating fluids of the body.

To show how the colloid chemical theory of water absorption and regulation is applicable to physiology and pathology, he gives some interesting biological observations which are of extreme interest, as illustrating how physico-chemical experiments *in vitro* closely resemble processes in the biological world.

The experiments and observations all tend to indicate that in every case of nephritis there is a production or accumulation of acid in the kidney and such an increased production or accumulation is the means of producing nephritis. The cause of nephritis other than acidosis is practically ignored. The author has not given critical and fair place to other theories concerned with the causation of this disease and the pathological processes which may both cause and result from it. He has put forward a very stimulating argument which cannot but be seriously considered by all those who take an interest in this disease. It is well, however, to sound a word of warning that there are many points which have been seriously controverted by other investigators. Before this work can be accepted as established, much additional and critical investigation must be undertaken.

NOTES ON BOOKS

The Diagnostics of Internal Medicine, by Glentworth Reeve Butler, M.D., Sc.D., LL.D. (D. Appleton & Company, 1922, price £2, 5s.) The appearance of a fourth edition of this book, containing a large amount of new material, is a proof that it has established a place for itself in modern medical literature. In the first part of the book, a full account is given of many clinical methods, including such complicated procedures as the determination of the hydrogen ion concentration

of the blood, and the estimation of non-protein blood nitrogen, by the method of Folin and Denis. Ordinary urine analysis, however, is omitted; and an account of the interpretation of electro-cardiograms might have been included with advantage. The chapter on the use of X-rays in diagnosis is disappointingly brief. The second part might almost have formed a short text-book of medicine; but the author considers the two parts complementary. A section on diseases of the mind is included.

Hyperpiesia and Hyperpiesis (*Hypertention*), by H. Batty Shaw. (London: Henry Frowde and Hodder & Stoughton, 1922. Price 21s. net.) This monograph is based on a clinical, pathological and experimental study of fifty cases in which the systolic blood pressure registered 150 mm. Hg., or more. The cases were of varied nature—chronic Bright's disease, renal sclerosis, "granular kidneys," "red granular kidneys," "fibroid kidneys," "aortic incompetence," lymphocythæmia, .broncho-pneumonia, etc. One of the patients, who died "merely of the hyperpiesia and attendant symptoms" had tortuous arteries, severe cardiac failure, an irregular pulse and chronic interstitial nephritis. On other pages we read of "hyperpiesic heart," "hyperpiesic murmurs" and "hyperpiesic albuminuria." It is evident that the hyperpiesic net is wide-flung. In the blood-pressure charts the absence of any record of the diastolic pressure detracts from their value. The section of the book dealing with the experimental search for substances capable of raising the blood pressure is critical and thoughtful. Towards the close of the book an instructive comparison is drawn between hyperpiesia and eclampsia, and attention is drawn to hyperpiesic crises, to the frequency of terminal infections and to hypopiesis. Although the text would have benefited by condensation, it bears ample evidence of being the work of one who is an apostle as well as a disciple of the hyperpiesic doctrine.

The Etiology and Pathology of Typhus, by S. Burt Wolbach, John L. Todd, and Francis W. Palfrey. This Report of the Typhus Research Commission of the League of Red Cross Societies to Poland (Harvard University Press, Cambridge, Mass, 1922), is dedicated to the memory of those investigators who contracted the disease and died, and it is much to be regretted that the entomologist of the Commission, Mr Bacot, who, while engaged in similar researches in Egypt this year, succumbed to an attack of the fever, must now be added to this already too long list of distinguished workers. The Report is based on the clinical, pathological, and bacteriological study of 181 cases of typhus in Warsaw. The work of the Commission has been very thoroughly done, and while largely confirmatory of the results of previous observers, is in itself highly suggestive and of great interest and value. It is impossible in this brief notice to do justice to the clinical and

pathological questions discussed in the Report. It is interesting to note that all attempts to find the bacillus described by Plotz ended in failure. The great care taken by the Commission to secure stocks of lice free from all micro-organisms and above suspicion undoubtedly adds value to their conclusions.

Text-Book of Surgery, by John A. C. Macewen, M.B., C.M., B.Sc. (Maclehose, Jackson & Co., 1922, price 30s. net.) This short text-book has been compiled from notes used by the author in his own lectures, and aims at supplying a reasonable amount of knowledge for the specific purposes of the student. Fractures and dislocations are omitted, as they are dealt with in a separate volume by the same author. The text is concise, and, for the most part, well recognised teaching is followed. Treatment is indicated briefly, except in a few conditions specially emphasised, such as hernia, where the well-known Macewen operation is fully dealt with. We cannot agree with all the opinions formulated—for example, the unreserved statement that excision of the hip for tubercle should be followed by active exercises, nor can we share the author's condemnation of pyelotomy for renal calculus. The book is plentifully supplied with illustrations, including some microphotographs, but these are on too small a scale to have much educative value to the student.

Psycho-Analysis, by A. A. Brill, M.D. (W. B. Saunders Co., 1922, price 24s. net). Dr Brill writes as a whole-hearted disciple of Freud, and the book may be taken as a safe guide to psycho-analytic theory and practice as distinguished from that of the post-psycho-analytic school with which the name of Jung is associated. It is necessary to emphasise the fundamental differences between the two schools, both in theory and practice. In the present (third) edition the task of embodying recent advances in the subject has been successfully accomplished. A chapter has been added on the Psychoses viewed from the standpoint of Psycho-analysis. In the opinion of the reviewer some previous knowledge of the subject is necessary to an adequate appreciation of this volume.

Practical Psycho-Analysis, by H. Somerville, B.Sc., L.R.C.P., M.R.C.S. (Baillière, Tindall & Cox, 1922, price 6s. net). The author suggests that "anyone who has read this little work carefully should be in a position to commence an analysis." The ways and mechanisms of unconscious mental functioning are discussed in sixteen pages, while fourteen pages are devoted to hints on how to do a Psycho-analysis. An understanding of psycho-analytic principles is an essential condition of successful practice, and such an understanding necessitates much reading, meditation, and observation; there is no short cut, and the attempt of the author to fashion one is to be deprecated. Judged as

an exposition of Freud's theory and practice, there is much in the book that is open to criticism.

Manual of Physio-Therapeutics, by Thomas Davey Luke, Second Edition (Wm. Heinemann, Ltd., 1922, price 25s. net). This book is divided into five sections, dealing with Thermotherapy, Massotherapy, The Rest Cure, Electrotherapy, and Dietotherapy, and each subject is treated in a systematic and comprehensive manner. Dr Luke's style is pithy and engaging, and he writes with the authority of a long and extensive experience. The illustrations are numerous and well chosen. An excellent addition to the section on Massotherapy is the description of the Bruce-Sutherland System of physical training, the excellence of which lies in its simplicity and efficiency as well as in its gradation, so necessary in any system of medical gymnastics.

The Treatment of Common Female Ailments, by Frederick John M'Cann, M.D., F.R.C.S. (Edward Arnold & Co., 1922, price 8s. 6d. net). This book is intended as a guide to medical practitioners in treatment of such common female ailments as are met with in the course of an ordinary general practice. It is written in an easy, conversational style, but sufficiently didactic where emphasis is desirable. There are chapters on Pain in the Pelvic Regions, Menstrual Disorders, Discharges, Displacements, Abortion, Puerperal Infection, Cancer, and other conditions met with by a doctor in his practice, in which knowledge of diagnosis and treatment may save his patient much suffering, and timely intervention may prolong life. Instructions regarding treatment are given fully and simply, with careful attention to detail.

Manual of Midwifery, by W. E. Fothergill, M.A., B.Sc., M.D. (W. Green & Sons, Ltd., 1922, price 10s. net.) During recent years the advances in the art of obstetrics have been of a comparatively trivial nature, hence this (the fifth) edition does not differ very much from the previous one. The indications for Cæsarean section have now become wider in range owing to improved results, and are well stated. Dr Fothergill is not fond of the douche or the plug in obstetrical treatment; the age of both, he says, has passed.

The correct management of difficult occipito-posterior positions, by timely manual or instrumental conversion into occipito-anterior positions, has now become so simple and is so successful that we think the method should have been fully described. In practical matters the advice is generally sound, and the work is well illustrated.

Handbook of Medical Jurisprudence and Toxicology, by W. A. Brend, Fourth Edition (Chas. Griffin & Co., 1922, price 10s. 6d.). The procedure outlined in this work is that used in the English Courts. Each subject is dealt with in a thoroughly practical manner;

and the author has attained brevity without sacrificing interest. A valuable chapter is that dealing with "Medical Privileges and Obligations," in which are discussed many problems of interest to every medical man. The value of this handbook to the Scottish practitioner would be enhanced if a short account of Scottish medico-legal procedure were included.

Cardiac Arrhythmia and the Neocardiology, by Alfred Webster, M.D. (Watts & Co., 1922, price 25s. net), consists mainly of a series of excellent sphygmographic tracings which are admirably reproduced. Among the best are those which were taken from the case of Stokes-Adams syndrome, reported in the Glasgow Hospital Reports of 1900, but the author has failed to grasp the true significance of his excellent records of auricular flutter. There are no original polygraphic tracings and no electro-cardiograms. The text, which is relatively scanty, offers an analysis of the cardiac disorders represented by sphygmograms. The book is clearly intended to be a serious denouncement of current beliefs regarding heart-block and auricular fibrillation. As the author's premises are often faulty, the obvious fallacy of many of his conclusions is a necessary sequence.

Ten Post-Graduate Lectures delivered before the Fellowship of Medicine during 1919-1920 have been issued as a volume (Bale, Sons, and Danielsson, London, 10s. 6d. net). Sir Clifford Allbutt contributes a Preface to the Lectures, which were given by Sir George Savage, Sir Hale White, Sir H. D. Rolleston, and others equally well worth listening to.

Dr Françon has placed his countrymen under some obligation by making Sir James Mackenzie's *Future of Medicine* more accessible to them. It is not necessary here to do more than announce that *L'Avenir de la Médécine* appears as the latest addition to the Librairie Felix Alcan (Paris, 1922, price 12 fr. net).

Dr Marcel Labbé's *Diabète Sucré*, which was noticed favourably recently in this column, has just been translated into English by Dr C. G. Cumston as *A Clinical Treatise on Diabetes* (Heinemann, 1922, price 18s. net). We have only to repeat the good opinion previously expressed, and to add that the translation contains several new chapters, notably one on the cure by fasting, which have not appeared in the latest French edition.

Practical Plant Biology, by Professor H. H. Dixon, Sc.D., F.R.S. (Longmans, Green & Co, 1922, price 6s. net), is the outcome of courses of lectures delivered to students of medicine. The author has presented facts in the morphology, physiology, and evolution, of types selected, in a clear manner. As an introductory Botany book it should prove very useful to students and others interested.

Notes on Books

The *Medical Annual*, 1922 (John Wright & Sons, Ltd., price 20s. net), now in its fortieth year, maintains its place as the best summary of the year's work published. We welcome the new arrangement of contents.

A Manual of Selected Biochemical Methods as applied to Urine, Blood, and Gastric Analysis, by Frank P. Underhill (Chapman & Hall, Ltd., 1921, price 17s. 6d. net), gives in a convenient form many of the methods recently introduced in the United States. In some instances accuracy has been somewhat sacrificed for the sake of simplicity, and we feel that the frequent use of colorimeter and nephelometer is to be deplored. A chapter on the chemical examination of fæces, and a few words on the interpretation of results, would add greatly to the value of the work. The book, however, is one which should find a place in every clinical research laboratory, for it contains descriptions of many methods for which one ordinarily has to search the pages of journals.

The second edition of *Laboratory Manual in General Microbiology*, by Ward Giltner (Chapman & Hall, price 21s. net), has undergone considerable revision, and as a laboratory guide has gained both in interest and usefulness. The exercises cover a wide field and are given in a clear and concise form. Several additions have been made in various sections of the book, including the Appendix, in which may be found valuable notes on Hydrogen-ion Concentration.

The Tuberculosis Clinic, edited by Noel D. Bardswell (John Bale, Sons, & Danielsson, price 6s. net), is a welcome and practical addition to the literature on the varying activities of the Tuberculosis Dispensary, which cannot fail to be of help to tuberculosis officers.

Surgical Pathology, by Eric Pearce Gould (J. & A. Churchill, price 6s. net), should be of considerable use to students for revision work, as it provides short, concise summaries of the main features of the various pathological changes found in surgical conditions.

New Periodicals.—We have received the first three numbers of the *Journal of Metabolic Research* (Physiatric Institute, Morristown, New Jersey, $10 per annum). It is edited by Dr Frederick Allen, and contains a number of important articles by him and his co-workers. The list of supporters on the title-page augurs well for the success of the journal.

The Archives of Medical Hydrology (Headley Bros., London, 10s. 6d. per annum) is the journal of the International Society of Medical Hydrology. It is introduced by Sir Clifford Allbutt and Professor Carnot, Paris. The first number contains papers by Leonard Hill, Monod, Bain, and others.

Books Received

The Ontario Journal of Neuro-psychiatry is the organ of the newly-formed Neuro-psychiatric Association of Ontario. The scope of the papers is wide, including the sociological and psychological aspects of nervous disease, as well as the purely clinical.

The Archives of Occupational Therapy, bi-monthly, is the official organ of the American Occupational Therapy Association (Williams and Wilkins Company, Baltimore, price $5 per volume). The first number contains a paper by Adolf Meyer of Johns Hopkins on the Philosophy of Occupational Therapy.

BOOKS RECEIVED

ANNUAL REPORT OF THE PUBLIC HEALTH COMMISSIONERS WITH THE GOVERNMENT OF INDIA for 1920 . . . . . Rs. 3.12

BALLANTYNE, J. W., Edited by. Encyclopædia Medica. Second Edition. Vol. VIII. . . . . (*W. Green & Son*)

BENNETT, R. ALLAN. "Suggestion" and Common Sense (*John Wright & Sons, Ltd.*) 6s.

BIRK, WALTER. Kinderkrankhelten . (*Marcus & Weber's Verlag*) 55 Marks

BLACKHAM, R. J. Aids to Tropical Hygiene. Second Edition (*Baillière, Tindall & Cox*) 4s. 6d.

BLARCOM, CAROLYN CONANT VAN. Obstetrical Nursing (*Macmillan & Co., Ltd.*) 15s.

BRIAND, A. T. Cancer: its Cause, Treatment, and Prevention (*Bale, Sons & Danielsson*) 8s. 6d

BRITISH MEDICAL ASSOCIATION. 90th Annual Meeting, Glasgow, 1922

CALENDAR OF THE SCHOOL OF MEDICINE OF THE ROYAL COLLEGES, EDINBURGH. Session 1922-1923 . . . (*The Darien Press*) 6d.

CRILE, GEORGE W., and Associates. Edited by Amy F. Rowland. The Thyroid Gland . . . . . (*W. B. Saunders Company*) 24s.

CURRIE, J. R. The Mustering of Medical Service in Scotland. 1914-1919 (*Morrison & Gibb, Ltd.*) Paper, 3s.; Cloth, 4s. 6d.

DERCUM, FRANCIS X. An Essay on the Physiology of Mind (*W. B. Saunders Company*) 8s. 6d.

DORLAND, W. A. NEWMAN. The American Illustrated Dictionary. Eleventh Edition . . . . . (*W. B. Saunders Company*) 35s.

FERRÉ, LOUIS. Traitement de la tuberculose irienne, par les rayons X (*Lyons Thesis*)

FISHBERG, MAURICE. Pulmonary Tuberculosis. Third Edition (*Henry Kimpton*) 42s.

GHOSH, R. Materia Medica and Therapeutics. Ninth Edition (*Hilton & Co.*) 10s. 6d.

GROVES, ERNEST W. HEY. A Synopsis of Surgery. Sixth Edition (*John Wright & Sons, Ltd.*) 17s. 6d.

GRULEE, CLIFFORD G. Infant Feeding. Fourth Edition (*W. B. Saunders Company*) 22s. 6d.

GUY'S HOSPITAL REPORTS. Vol. LXXII. No. 3 (*Henry Frowde and Hodder & Stoughton*) 12s. 6d.

HAAS, P., and T. G. HILL. The Chemistry of Plant Products. Vol. II., Metabolic Processes . . . . . (*Longmans, Green & Co.*) 7s. 6d.

HARRIS, L. Diseases of the Heart . . . (*Baillière, Tindall & Cox*) 10s. 6d.

Books Received

HAZEN, HENRY H. Diseases of the Skin. Second Edition (*Henry Kimpton*) 37s. 6d.

HERTZLER, ARTHUR E. Diseases of the Thyroid Gland (*Henry Kimpton*) 25s.

HILL, LEWIS WEBB. Practical Infant Feeding (*W. B. Saunders Company*) 24s.

INDIAN JOURNAL OF MEDICAL RESEARCH, June 1922 . . . . . Rs. 3.8

JELLIFFE, SMITH ELY, and LOUISE BRINK. Psycho-Analyses and the Drama. ("Nervous and Mental Disease," Monographs Series, No. 34) $3

JORDAN, EDWIN O. General Bacteriology. Seventh Edition (*W. B. Saunders Company*) 25s.

KELLY, HOWARD A., and C. F. BURNAM. Diseases of the Kidneys, Ureters, and Bladder. In 2 vols. Second Edition (*D. Appleton & Co.*) 63s.

LONDON COUNTY COUNCIL PUBLIC HEALTH REPORT, 1921

MASON, F. RAOUL, Translated by. Endocrine Glands and The Sympathetic System . . . . . (*J. B. Lippincott Company*) 25s.

MEEK, ALEXANDER. Essentials of Zoology (*Longmans, Green & Co.*) 10s. 6d.

MELLISH, M. H., Edited by. Collected Papers of the Mayo Clinic. Vol. XIII. 1921. . . . . (*W. B. Saunders Company*) 60s.

MIX, CHARLES L. The Practical Medicine Series. Vol. I., General Medicine . . . . . (*The Year Book Publishers*) $3.

MUKHERJI, S. K. Infantile Cirrhosis of Liver . (*The Calcutta Press*)

OELZE, F. W. Untersuchungen ueber den Syphiliserreger. (*Leopold Voss*) 75 Marks

PRICE, F. W., Edited by. Text-book of the Practice of Medicine (*Oxford Medical Publications*) 35s.

PRITCHARD, ERIC. The Physiological Feeding of Infants and Children. Fourth Edition . . . . . (*Henry Kimpton*) 21s.

PYBUS, F. C. The Surgical Diseases of Children (*H. K. Lewis & Co., Ltd.*) 18s.

REPORT ON THE HEALTH OF THE CITY OF LIVERPOOL during 1921

RESEARCH STUDIES IN MEDICAL HISTORY. No. 1. John Arderne (*John Bale, Sons, & Danielsson, Ltd.*) 10s. 6d.

SCHAMBERG, JAY FRANK. Diseases of the Skin and the Eruptive Fevers. Fourth Edition . . . . . (*W. B. Saunders Company*) 25s.

SMITH, CHARLES EDWARD. From the Deep of the Sea (*Messrs A. & C. Black*) 10s. 6d.

SOLLMANN, TORALD. A Manual of Pharmacology. Second Edition (*W. B. Saunders Company*) 32s. 6d.

STEADMAN, F. ST J. Notes on Bacteriology for Dental Students (*John Bale, Sons, & Danielsson, Ltd.*) 3s. 6d.

STOOKEY, BYRON. Surgical and Mechanical Treatment of Peripheral Nerves . . . . . (*W. B. Saunders Company*) 48s.

SUTHERLAND, WM. G. Dispensing Made Easy. Fifth Edition (*John Wright & Sons, Ltd.*) 6s.

TRANSACTIONS OF THE AMERICAN PEDIATRIC SOCIETY. Vol. XXXIV.

TREDGOLD, A. F. Mental Deficiency. Fourth Edition (*Baillière, Tindall & Cox*) 21s.

ULLMANN, KARL, Edited by. Die Schädigungen der Haut. Bd. I. Lief. 2 8 . . . . . (*Leopold Voss*) 32s.

WALMSLEY, THOMAS. A Manual of Practical Anatomy. Part III. The Head and Neck . . . . . (*Longmans, Green & Co.*) 10s. 6d.

WILLIUS, FREDERICK A. Clinical Electrocardiography (*W. B. Saunders Company*) 25s.

ZUMBUSCH, LEO V. Atlas of Syphilis (*John Bale, Sons, & Danielsson, Ltd.*) 30s.

Edinburgh Medical Journal

December 1922

EARLY ANATOMICAL INSTRUCTION AT EDINBURGH.

JOHN D. COMRIE, M.A., B.Sc., M.D., F.R.C.P., Assistant Physician, Royal Infirmary; Physician, Deaconess Hospital, Edinburgh. Late Consulting Physician to the Forces in North Russia.

In Scotland, as in other countries, from the earliest times, churchmen with a knowledge of medicine were found in the religious houses, and there existed in the Highlands a peculiar type of hereditary doctor or "Irish leech," attached to some of the great families, medical traditions being handed down from father to son through many generations.

In the towns, and notably in Edinburgh, there were guilds of barber-surgeons as of other trades, and in fifteenth-century Edinburgh, the Brethren of the Guild of Surgeons and Barbers maintained an altar where daily service was held in the Collegiate Kirk of St Giles, under the patronage of St Mungo. So important did the Surgeons and Barbers become among their fellow-citizens, that in the year 1505 the guild received a Charter of Incorporation from the Town Council, confirmed next year by James IV. Among the conditions[1] stipulated in this charter was a provision that every man before he became a freeman and master of the craft should submit to an examination in the following points "thatt he knaw anotomea, nature and complexioun of every member In manis bodie And in lykewayes he knaw all the vaynis of the samyn thatt he may mak flewbothomea in dew tyme And als that he knaw in quhilk member the signe hes domination for the time." Further, no master was to take an apprentice to practise the craft of surgery unless he could both write and read, a sign of unusual erudition in those days. A noteworthy concession by the Town Council, as indicating the beginning of public teaching, is the grant to the guild "that we may have anis in the yeir ane condampnit man efter he be deid to mak

antomea of quhairthrow we may haif experience Ilk ane to instruct utheris." Doubtless the yearly anatomical demonstration was carried out in the same manner as that by which Mondino had lectured at Bologna two centuries earlier, and seeing there was much intercourse in the sixteenth century between Scotland and the Continent, probably Mondino's little text-book was used, or that of his contemporary, Henri de Mondeville of Paris and Montpellier. Although public dissections had been carried out in most of the Continental Universities in the fourteenth and fifteenth centuries (Venice from 1308), this was the first enactment on the subject in Britain, preceding even the law of Henry VIII. in 1540, by which four bodies of executed criminals were granted to the Barber-Surgeons of London.

During the next half century Edinburgh suffered several disasters, commencing with the battle of Flodden and continued by the destruction wrought in the English invasions under Somerset. In 1558, indeed, the Incorporation of Surgeons supplied twenty-five of their number, including apprentices, to a force of Scots and French operating against "our auld inemyes of England."[2] There was little likelihood, therefore, that any great development would take place in anatomical instruction, but apparently the demonstrations on the cadaver were valued and continued. Of the Scotsmen who became distinguished in the healing art during the sixteenth century, the following deserve remark. Henry Blackwood of Dunfermline taught at Paris in 1551, and later reached the exalted position of Dean of the Faculty of Medicine at Paris.[3] Mark Duncan of Roxburghshire became Regent of the University of Saumur in 1589.[4] Peter Lowe of Errol served for twenty-eight years in the armies of France, became surgeon to Henry IV., and finally, retiring to his native land, settled at Glasgow in 1598. His *Whole Art of Surgery* (published 1597) contains several anatomical plates borrowed from Paré and Vesalius, which illustrate the anatomical teaching in Scotland at the end of the sixteenth century.[5] The careers of these three men serve to remind us of the intimate relations subsisting between France and Scotland throughout this century, when French physicians and surgeons also came to Edinburgh. Among these latter may be mentioned Gilaume Cassanate from Besançon in Burgundy, who, under protection of the Regent Earl of Arran, practised in Edinburgh for many years, as he himself

says in a letter to Jerome Cardan, labouring against envy, his income not so much as his expenses, till he turned his attention to treatment in phthisis, of which he "cured many who still survive" (1551).[6] There was thus much medical intercourse between Scotland and France, and some of these early Scottish surgeons learned anatomy abroad.

Of the native Edinburgh surgeons may be mentioned Anthone Brisset, who treated Queen Mary of Guise (1542), Gilbert Skene, who published at Edinburgh a treatise on the Plague (1568), John Chisholm, who operated on the Regent Earl of Morton for strangulated hernia (1572), and Gilbert Primrose, Chirurgeon to James VI. and Deacon of the Craft of Chirurgeons (1583), under whom this guild was granted pre-eminence among the Trade Guilds of Edinburgh. An apprentice of the last in 1587 was John Naysmyth, later Chief Surgeon to the Scots Guards of the King of France.[7]

The social status and professional skill of these sixteenth-century Master Surgeons of Edinburgh relative to other callings and to the general knowledge of the time was at least as high as that of surgeons at the present day. Several of them possessed considerable heritable property in the city or estates in its vicinity. Their number was not large, as may be gathered from the fact that in the year 1648 they totalled only ten.[8]

When we come to the year 1645 we find for the first time a definite teacher of Anatomy mentioned. Up till now the Master Surgeons had presumably given the yearly demonstrations in rotation conformably to the words of the original charter "ilk ane to instruct utheris." In this year James Borthwick, a burgess of Edinburgh, having duly passed his examination, was admitted as a Master Surgeon for the special purpose of "desceting of anatomie for the farder instruction of prentissis and servandis." Borthwick's admission was a special one; he paid 200 pounds of entry fee instead of the statutory 5 pounds.[9] Instead of the usual apprenticeship he had served abroad as a surgeon along with Alexander Penicuik (Deacon of the Craft in 1645), who had been surgeon to General Bannier (Commander of the Swedish Forces in the Thirty Years' War), and later Chirurgeon-General to the Auxiliary Scots Army in England (during the Civil War).[10] It had been the custom till now to hold the meetings of the Craft in the house of the Deacon for the time being, and one can

imagine that the anatomical instruction must have caused some awkwardness in his domestic arrangements. In 1647, however, David Kennedy and James Borthwick reported that they had taken as a place of meeting, "three rowmes of ane tenement of land in Diksone Close, for payment of fourtie poundis zeirlie."[11]

By 1669 it was found that even this was unsuitable, and the craft decided to build a "conveening house" on a piece of ground, in the south-east angle of the city wall, presented to them by the Town Council in 1656, each member subscribing £100 for that purpose.[12] On 24th October 1694 a member of the Incorporation, Alexander Monteath, apparently on the instigation of Dr Pitcairn, obtained from the Town Council a gift for thirteen years "of those bodies that dye in the correction-house," and of "the bodies of fundlings that dye upon the breast," together with a room for dissections. Immediately the other members of the Incorporation presented a petition (2nd November 1694) for similar privileges. The ingenuity of the Town Council was somewhat taxed to discover other sources of anatomical material, but they succeeded by granting "the bodies of fundlings who dye betwixt the tyme that they are weaned and their being put to schools or trades; also the dead bodies of such as are stiflet in the birth, which are exposed, and have none to owne them; as also the dead bodies of such as are *felo de se*, and have none to owne them; likewayes the bodies of such as are put to death by sentence of the magistrat, and have none to owne them." The grant was to take effect in the winter time and there was an important condition attached, that the petitioners should by Michaelmas 1697 build, repair, and have in readiness an anatomical theatre for public dissections, the hall of 1669 being apparently not large enough or otherwise unsuitable.[13]

The new Surgeons' Hall was ready on the site of the old one, and the gift confirmed by December 1697, and from this time the teaching of anatomy in Edinburgh became systematic. Pitcairn and Monteath joined other members of the Incorporation in giving combined anatomical demonstrations, and we find Pitcairn writing in 1694 to a friend in London that he proposed "to make better improvements in anatomy than have been made in Leyden these thirty years."[14] A professor of Botany (James Sutherland) had already been appointed by the Town Council in 1676, and three professors of Medicine

(Dr A. Pitcairn, Sir Robert Sibbald, and Dr James Halket) in 1685, this period marking the virtual commencement of a Medical School at Edinburgh.

There is a minute of the Incorporation for January 1703 showing how the anatomical demonstrations were then (November 1702) carried out by the various members appointed for the purpose:—*First day*, a general discourse on anatomy, and the common teguments and muscles of the abdomen, by James Hamilton, the Deacon. *Second day*, the peritoneum, omentum, stomach, intestines, mesentery, and pancreas, by John Baillie. *Third day*, the liver, spleen, kidneys, ureters, bladder, and parts of generation by Alexander Monteath. *Fourth day*, the brain and its membranes, with a discourse of the animal spirits by David Fyfe. *Fifth day*, the muscles of the extremities by Hugh Paterson. *Sixth day*, the skeleton in general, with the head, by Robert Clerk. *Seventh day*, the articulations and the rest of the skeleton, by James Auchinleck. *Eighth day*, the epilogue by Dr Pitcairn.[15]

Another and longer course of demonstrations is minuted in the records of the surgeons (18th May 1704) as having taken place in the preceding April. It was as follows:—*First day*, James Hamilton, a discourse on anatomie in generall with a dissection and demonstration of the common teguments and muscles of the abdomen. *Second day*, John Mirrie, the umbilicus, omentum, peritoneum, stomach, pancreas, intestines, vasa lactea, mesentery, receptaculum chyli, and ductus thoracicus. *Third day*, Mr Alexander Nisbet, the liver, vesica fellis, with their vessels, spleen, kidneys, glandulæ renales, ureters, and bladder. *Fourth day*, George Dundas, the organs of generation in a woman, with a discourse of hernia. *Fifth day*, Robert Swintoun, the containing and contained parts of the thorax, with the circulation of the blood and respiration. *Sixth day*, Henry Hamilton, the hair, teguments, dura, and pia mater, cerebrum, cerebellum, medulla oblongata, and nerves within the head. *Seventh day*, Robert Eliot, the five externall senses, with a demonstration of their severall organs. *Eighth day*, John Jossy, the muscles of the neck and arm with a discourse on muscular motion. *Ninth day*, Walter Potter, the muscles of the back, thigh, and legg. The *epilogue* or conclusion by Dr Archibald Pitcairn.[16]

About the year 1705 there appears to have been a general desire that one man should take over the management of these

lectures and there was considerable competition for the privilege of being appointed to do this. Robert Eliot was chosen by the Incorporation as "public dissector," and later in the same year (29th August 1705) he also received from the Town Council a salary of £15 per annum. Eliot was thus the first "Professor of Anatomy" in the Town's College, and the earliest professor of this subject in Britain. The appointment was a double one, the town providing the salary and the surgeons supplying the theatre. In 1708 at his request Adam Drummond was conjoined with him in this post, receiving half of the salary.[17]

Anatomy now became a very popular study, and the supply of bodies from the sources already mentioned proving inadequate, recourse was had to body-snatching. As early as 1711 there were great complaints of graves in Edinburgh being rifled. The Incorporation of Surgeons felt themselves called upon to forward to the magistrates a memorial which, in the first place, denounced this as "a scandalous report most maliciously spread about the town," and entreated the magistrates to exert their utmost power for the "discovery of such atrocious and wicked crimes." Also expulsion from the Incorporation was threatened against any of its members or apprentices who should be found concerned in the foresaid crimes. The whole memorial, however, sounds rather exculpatory than sincere, and the practice probably continued though with greater precaution.[18]

On the death of Robert Eliot in 1717, John M'Gill was associated with Adam Drummond as Joint Professor of Anatomy in the Town's College. Two years later they resigned their posts—"as the state of their health and business were such that they could not duly attend the said professorships"—in favour of Alexander Monro (*primus*). Monro, a young man of twenty-two, who had a special knowledge of anatomy, had studied under Cheselden in London, and had been admitted a Master of the Calling only three months previously, was thereupon (29th January 1720) elected "Professor of Anatomy in this city (Edinburgh) and college," the yearly salary of £15 being continued. On 14th March 1722 Monro's appointment was confirmed *aut vitam aut culpam*, instead of the previous tenure of office "during the Council's pleasure."[19]

In 1718 Alexander Monro had presented to the surgeons "some anatomical pieces done by himself," including an articulated skeleton in a glass case, and dissections preserved

in spirit; of which the skeleton and case are still extant. Monro lectured in the Hall of the Surgeons from 1719 till 1725, when, following upon a public riot directed against body-snatching, he removed his preparations for greater security within the walls of the University as the Town's College had come by this time to be called.[20] Once more on this occasion (17th April 1725) the Incorporation of Chirurgeons published a notice, which was printed and distributed through the town, deprecating and denying body-snatching. It contains the following curious passage:—

"As also the Incorporation understanding that country-people and servants in town are frightened by a villanous report that they are in danger of being attacked and seized by Chirurgeons' apprentices in order to be dissected; and although this report will appear ridiculous and incredible to any thinking person, yet the Incorporation, for finding out the foundation and rise thereof, do promise a reward of five pounds stg., for discovering such as have given just ground for this report, whether they be Chirurgeons' apprentices or others personating them in their rambles or using this cover for executing their other villanous designs."

There are, however, records which give some colour to this report: for example, in 1724 after a woman had been executed, there ensued a fight between her friends and some surgeon apprentices for possession of the body. In the middle of the fracas the supposed corpse came to life, and lived for many years with the popular appellation of "half hangit Maggie Dickson." It was not till a century later that the report received dreadful confirmation in the revelations at the trial of Burke and Hare.[21]

Monro (*primus*) being appointed Professor of Anatomy, immediately introduced an extended course of instruction lasting from October to May, and embracing the following subjects:—He began with a history of anatomy which he apparently treated very fully. Next he took up osteology, dealing not only with the form and structure of the bones, but also with their uses and the diseases and accidents to which each is liable. Next he demonstrated on adult subjects the muscles, viscera, and brain, and on the bodies of children the nerves and blood-vessels, again dealing not only with anatomy as we regard it, but with disease in the various organs. He further illustrated the anatomy of the human body by the

dissection of various quadrupeds, fowls, and fishes, comparing the structure and uses of their organs with those of the human body. He proceeded then to consider the diseases for which chirurgical operations were commonly undertaken, and to demonstrate the operations on the cadaver, as well as the bandages and various instruments and appliances used in surgery. Finally he concluded his winter course with some general lectures on physiology.[22]

This course was continued every winter for nearly forty years, a period during which the numbers of students attracted to Edinburgh yearly increased. His best-known work is a *Treatise on Osteology*, which went through many English editions, and which was translated into French and published as a large folio volume with magnificent copper-plates by M. Sue, Demonstrator of Anatomy to the Royal Schools of Surgery at Paris (1759). Besides this he published some fifty short papers, some anatomical, some surgical, not of any great importance or permanent interest.

His son Alexander Monro (*secundus*) was educated with a view to succeeding his father in the Chair of Anatomy, and at the age of twenty-one was elected Conjoint Professor, taking full charge of the department at the age of twenty-five, in 1758, when the first Monro restricted himself to teaching clinical medicine. Placed in easy circumstances from the outset, and provided with a class which came to him independently of any attractions he had to offer, Monro *secundus* might well have failed to reach the success as a teacher and as a citizen to which the first Monro had by his efforts attained. Yet the second Monro showed himself the greater man both as a teacher and investigator, and, among more brilliant colleagues than those with whom his father had had to compete, he maintained an easy ascendancy as the acknowledged head of the developing medical school.

It is useful, as showing the progress of the Edinburgh Medical School, to consider the number of students attending the Anatomy class during the decennial periods throughout the regime of the first two Monros.[23]

In 1720. . . .	57	Average 1760-1770 . .	194
„ 1730. . . .	83	„ 1770-1780 . .	287
„ 1740. . . .	130	„ 1780-1890 . .	342
„ 1750. . . .	158	After 1800 over . .	400

A short account of the lectures delivered by Monro *secundus*

280 1

THE "TENEMENT" IN DICKSON'S CLOSE.

The stair and walls are still standing, though the overhanging timber front has been removed.
Sketch by James Drummond, R.S.A., in 1850.

SKETCH IN R.C.S. OF THE SURGEONS' HALL OF 1697.
The lower flat with the door and date still stands ; a third flat has been added.
(*Photo by* D. M. Greig, Esq., F.R.C.S.)

S. W. CORNER OF SURGEON SQUARE IN 1829.

Showing from left, Surgeons' Hall, Gordon's Class Room, Royal Medical Society's Hall, and Knox's (formerly Barclay's) Class Room. From *Old and New Edinburgh.*

1. 2. 3.

THREE PORTRAITS FROM THE HALL OF THE ROYAL COLLEGE OF SURGEONS.

1. James Borthwick (1615-1675), the first special demonstrator of Anatomy in Edinburgh (Photo by D. M. Greig, Esq., F.R.C.S.).
2. Archibald Pitcairn (1652-1713), Professor of Medicine in Leyden and Edinburgh.
3. James Hamilton, Deacon of Surgeons' Incorporation when first Anatomical "Course" was held in 1702.

is given in the Memoir of his son. Monro was accustomed after very careful preparation to lecture in an extempore manner from headings, but a manuscript copy in excellent handwriting taken down by one of his students is preserved in the Library of the Edinburgh College of Physicians, and another in the Museum of the College of Surgeons.

With regard to the contributions made by Monro *secundus* to the increase of anatomical knowledge, it is a striking fact that none of the great works on which his reputation chiefly rests was published till after he was fifty years of age. These were *Observations on the Structure and Functions of the Nervous System* (1783), *The Structure and Physiology of Fishes explained and compared with those of Man and other Animals* (1785), *Description of the Bursæ Mucosæ of the Human Body* (1788), and *Treatise on the Brain, the Eye, and the Ear* (1797).

A. Monro (*secundus*).
(From *Kay's Portraits.*)

One of Monro's earliest fields of inquiry was on the function of the lymphatic vessels, and his dispute with William Hunter for priority in the elucidation of their nature was one of the celebrated medical controversies of the eighteenth century. The lacteals had been noticed first by Aselli in 1622, the thoracic duct discovered by Pecquet in 1651, while Rudbeck in 1651 and Bartholin in 1652 had found other parts of the system. Nuck had injected the passages through the glands, and Ruysch had described the valves in the vessels, while Meckel had given a general account of the whole lymphatic system. Nobody, however, up to 1755 had supposed that the lymphatic vessels were more than a class of very small veins originating like the "red veins" from the arteries. Monro *secundus* while in Berlin in 1757 published a Latin thesis, *De Venis Lymphaticis*

Valvulosis, in which he deals with their origin from spaces in the connective tissues. Hunter had mentioned the same thing in his lectures, and suggested that the lymphatics are the absorbents of the body, and Monro charged Hunter with having adopted the idea from him. He supported his contention by a letter from Joseph Black, dated 24th March 1758, in which Black states that Monro had shown him a paper in 1755 in which he maintained that the lymphatics "are a distinct system of vessels, having no immediate connection with the arteries and veins, but arising, in small branches, from all the cavities and cells in the body, into which fluids are thrown; and that their use is to absorb the whole, or the thinner parts, of these fluids, and restore them to the mass of circulating humours."[24] Monro's main method of proof had been by injecting the arteries in such a way as to rupture them, when he found that the injection fluid passed from the alveolar spaces into the neighbouring lymphatics, and on the balance of probability the original discovery that the lymphatics form an independent absorbent system is really his.

A similar controversy was later raised with Hewson, who had been a pupil of Monro in Edinburgh and of Hunter in London, and who published in 1774 his celebrated *Description of the Lymphatic System in the Human Subject and in other Animals.* The dispute this time was whether he or Monro had first discovered lymphatics in birds, amphibians, etc.[25] It is quite clear that Monro had shown injections of the lymphatics in these animals to his class before Hewson became a medical student, but he certainly never described and figured them with the fullness and accuracy of the latter's work.

Monro's *Observations on the Structure and Functions of the Nervous System* (1783), not only summarised and illustrated by admirable plates the current knowledge of the time, but contained numerous additions from his own observation. Among the new points described may be mentioned the foramen connecting the lateral and third ventricles which has made his name familiar to every medical student. Monro's description runs—"So far back as the year 1753, soon after I began the study of Anatomy, I discovered that the Lateral Ventricles of the Human Brain communicated with each other, and at the same place, with the middle or Third Ventricle of the Brain; and, as a passage from the Third Ventricle to the Fourth is universally known, it followed that what are called

the Four Ventricles of the Brain are in reality different parts of one cavity."[26] The first observation of this foramen was made on a case of tuberculous meningitis seen in consultation with Robert Whytt, which also furnished the latter with part of the material for his original description of this disease.[27]

The Structure and Physiology of Fishes (1785) was the first important work on Comparative Anatomy in Edinburgh, and founded a taste in Scotland for that branch of Science which had been recently introduced and elaborated by the Hunters and their pupils in London. His *Description of the Bursæ Mucosæ of the Human Body* (1788) was of a more practical type, and of great importance in relation to Surgery. Soemmering, who had been one of his pupils, gives an appreciation of the research as follows—"Monro, who first properly explained their anatomy, and uses, in his excellent monograph upon this subject, has made us acquainted with no less than seventy pairs, all situated in the extremities; and since his day the number has been further increased by the discoveries of Beclard and others; so that anatomists are now acquainted with upwards of one hundred pairs, many of them situated in the head and trunk."[28]

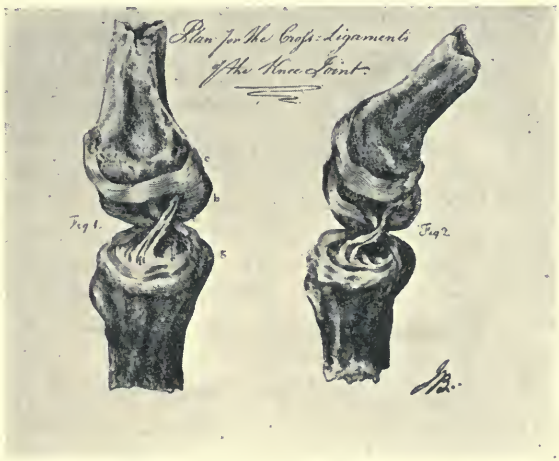
A. Monro (*tertius*).
(From *Modern Athenians.*)

Towards the end of the year 1798 Monro *secundus* petitioned the Town Council to appoint as his colleague and successor his eldest son, Alexander, then twenty-five years old, afterwards known as Monro *tertius*. The Town Council after some demur agreed, and the two Monros held the Chair of Anatomy conjointly for the next ten years, Monro *secundus* retiring in 1808. Monro *tertius* held the Chair till 1846, thus continuing the regime of his family through the long period of 126 years. The experiment of slipping a son in early life into the position of colleague to become later sole professor had been very successful as between Monro *primus* and Monro *secundus*, but on the second occasion, as between Monro

secundus and Monro *tertius*, it proved a lamentable failure. Monro *tertius* showed himself an unsuccessful teacher, his students very commonly paying the University fee and getting their instruction from outside teachers, while his voluminous writings are dull and devoid of any initiative or novelty. A recent writer says of him: "He used to read his grandfather's lectures written about a century before; and even the shower of peas with which the expectant students greeted his annual reference, 'When I was a student in Leyden in 1719'—failed to induce him to alter the dates."[20] The chief regret about Monro's appointment is that one or other of two brilliant brothers might have been secured, and if the appointment had been made open, either John or Charles Bell, with the advantages of position and wealth which the Town Council conferred upon Monro *tertius*, would undoubtedly have reflected great lustre upon the Edinburgh Anatomical School.

We must now consider the extra-academical teachers of Anatomy. The teaching of this subject began with the Guild of the Surgeons and Barbers long before the Town's College was founded. The capable brain of Dr Archibald Pitcairn about 1680 conceived the idea of founding a medical school in Edinburgh; he was one of the three Professors of Medicine appointed in 1685 to the Town's College or University as it then began to be called; and in the combined anatomical demonstrations of the Surgeons' Incorporation after his return from the Leyden professorship, he was, in 1702 and 1704, as we have seen, the guiding spirit. During the first sixty years of the Monro regime, the University had a monopoly of anatomical teaching, but it is a significant fact that though the first two Monros lectured on Surgery, neither was an operating surgeon, and the second was a consulting physician with large practice. Anatomy in their hands, though brilliantly taught, naturally tended to become a formal systematic subject, and in 1786, John Bell, returning to Edinburgh and becoming a Fellow of the College of Surgeons, saw a great chance. In his *Letters on the Education of a Surgeon*, published in 1810, he says, "In Dr Monro's class, unless there be a fortunate succession of bloody murders, not three subjects are dissected in the year. On the remains of a subject fished up from the bottom of a tub of spirits, are demonstrated those delicate nerves, which are to be avoided or divided in our operations; and these are demonstrated once at the distance of 100 feet!

nerves and arteries which the surgeon has to dissect, at the peril of his patient's life."[30] John Bell, therefore, began to lecture, and so successful was he in attracting students that in 1790 he built an anatomical school, adjoining on the east the Hall of the Surgeons in what was later called Surgeon Square. He was not only an expert anatomist, but a good classical scholar, a skilful draughtsman and etcher, a ready speaker and a polished writer. It is no exaggeration to say that he founded the subject of Surgical Anatomy. The works and atlases of the great anatomists in the eighteenth century, *e.g.* Cheselden, Albinus, Haller, Winslow, Scarpa, Soemmering,



ETCHING BY JOHN BELL FOR *Engravings of the Bones, Muscles, and Joints.*

even the Hunters, all treat the subject from the purely structural point of view. By these men the various systems and organs are correctly and often beautifully described and figured, but the engravings of John Bell, and later of his brother Charles, have a teleological significance, their aim being not so much correctness, as utility to the operating surgeon. This feature is readily seen in John Bell's *Engravings of the Bones, Muscles, and Joints*, drawn and engraved by himself (1794). Bell was essentially a surgeon, and his only other anatomical work was the *Anatomy of the Human Body*, published Vol. I., 1793; Vol. II., 1797; Vol. III., 1802. He taught anatomy for thirteen years and gave it up under peculiar circumstances. So successful had his anatomical classes proved, that a combina-

tion led by Dr James Gregory, Professor of the Practice of Medicine in the University, was formed against him, and he was pursued in a manner which for audacity, if not for bitterness, would be well-nigh impossible at the present day. The attack opened with a pamphlet addressed to students warning them against attending Mr Bell's lectures. It was followed by a *Review of the Writings of John Bell, Surgeon in Edinburgh, by Jonathan Dawplucker* (Professor Gregory). This malignant attack was, as Bell states, "Stuck up like a Play-Bill in a most conspicuous and unusual manner, on every corner of the city; on the door of my lecture-room, on the gates of the College, where my pupils could not but pass, and on the gates of the Infirmary, where I went to perform my operations." As an example of the level of personal abuse to which Gregory descended may be cited: "Any man, if himself or his family were sick, should as soon think of calling in a mad dog, as Mr John Bell." Bell replied at a later period to these attacks with dignity, though pungently and effectively, in a voluminous collection of "Letters."[31] But Gregory's party having secured his exclusion from the hospital, there was nothing to be gained by Bell from further teaching. He therefore ceased to lecture in 1799, confining himself to surgical practice, in which he was for about twenty years the leading operator and consultant throughout Scotland.

Charles Bell was younger than his brother John by eleven years and was trained by him in anatomy and surgery. In this there is a sort of comparison with the brothers William and John Hunter half a century earlier. Charles Bell began to assist in the anatomical class while still comparatively a boy, and, like John Bell, he had a genius for anatomical delineation. The same teleological tendency is seen in his drawings, directed in his earlier works like that of his brother towards surgery. These earlier works were a *System of Dissections* (published 1792-1803), and *Engravings of the Arteries, of the Nerves, and of the Brain* (published 1801 and 1802), while his *Anatomy of Expression* though not published till 1806 in London was mainly composed in Edinburgh. After the withdrawal of John Bell from teaching, Charles took over the anatomy class in 1799, but the opposition to his brother militated against his success and he never attracted more than ninety students. He determined therefore in 1804 to remove to London, where in 1811 he took over the old Hunterian Anatomical School in

Windmill Street, and where he spent thirty-two busy and eventful years. The Edinburgh School made some amends to Bell and to its own reputation by offering him the Chair of Surgery in 1836, when the Gregory faction had passed away. We are not concerned here with his London period, but one important field of his activities must be mentioned, to which he had been directing attention in the early Edinburgh days, and upon which his fame largely rests. Since the days of Whytt and Haller the minute ramifications of the nervous system had been a matter of common knowledge; but the nerves were regarded as merely exerting some vague influence over the parts to which they were distributed and effecting a sympathy between different regions of the body. Whytt in 1755 was ahead of his time in expressing the opinion that "the power of motion, when stimulated, proceeds from the nerves, or is at least immediately dependent on their influence."[32] Charles Bell was the first to whom it occurred that definite nerves have a definite course from some part of the brain to a certain portion of the periphery, and further, that different nerves have quite distinct functions. This led to his *Idea of a New Anatomy of the Brain*, printed for distribution in 1811, but often mentioned by him before that time. This publication included the specific instance of the motor function of the anterior nerve roots, first discovered by him. It led to the more complete demonstration of motor and sensory nerves by Magendie in 1822, to the localisation of the *noeud vital* by Flourens in 1837, and to the great subsequent developments in mapping out nerve paths and centres in the brain and cord.

PLATE SHOWING THE GROUP OF "RESPIRATORY NERVES."
(Drawn by C. Bell for his *Nervous System.*)

Charles Bell, like Harvey, was thus a pioneer in scientific medicine, and it gives no cause for wonder that on one occasion when Bell was visiting Paris, Roux dismissed his class without

the lecture for the day with the words, "C'est assez, Messieurs, vous avez vu Charles Bell."[33]

The episode of surgical anatomy in Edinburgh ended for a time when Charles Bell shook off the dust from his feet against this city in 1804, but this branch was revived some twenty years later by a brilliant group of surgeon anatomists including Lizars, Liston, Syme, and Fergusson.

An important place as a teacher of anatomy was filled by John Barclay, who having originally studied for the Church, took the M.D. degree at the somewhat ripe age of thirty-six, and became an assistant to John Bell. In 1797 he began to teach anatomy on his own account, and in 1804 when Charles Bell departed for London his course of lectures was "recognized" by the College of Surgeons. After the year 1808 the retiral of Monro *secundus* and the ineptitude of the third Monro helped Barclay's class, which gradually rose to 300 students, the University class sinking from 400 under Monro *secundus* to 200 by the year 1821. Barclay had taken a house on the west side of Surgeon Square (No. 10, next door to the Royal Medical Society's premises) which had been used for lectures by Andrew Duncan, sen., and which he fitted up as an anatomical school.[34] Here he collected a valuable museum of human and comparative anatomy, and lectured twice daily. We have seen that Monro *secundus* took considerable interest in the subject of comparative anatomy, and Barclay now greatly developed it. He also made a considerable reputation by the publication of several valuable works, especially his *New Anatomical Nomenclature* (1803), *The Muscular Motions of the Human Body* (1808), and *Engravings representing the Bones of the Human Skeleton, with the Skeletons of some of the Lower Animals* (1819). He had a philosophic conception as well as an extensive knowledge of comparative anatomy, and was one of the first to recognise that all animals have the same general outline of structure, as well as the principle of homology in the two limbs. It was proposed indeed to make for him a Chair of Comparative Anatomy in the University, though this was vehemently opposed by Monro and Jamieson, the Professors of Anatomy and Natural History respectively.[35] The proposal, though it never eventuated, gave rise to much discussion, personal, political, and scientific, and in Kay's Edinburgh Portraits there is a contemporary caricature showing several of the participants, entitled "The Craft in Danger."[36]

Contemporary with Barclay was Dr John Gordon, who lectured next door to him, at No. 9 Surgeon Square, from 1808 to 1818, to a class of about a hundred students. Apart from his activities as a teacher, his best-known work was *Observations on the Structure of the Brain, comprising an Estimate of the Claims of Drs Gall and Spurzheim to Discovery in the Anatomy of that Organ.* This attempt to show that the claims of these two men to have localised various faculties in different parts of the brain were inadmissible, went far in this country at least to discredit the science of Phrenology.

He was succeeded by David Craigie who wrote the excellent

CARICATURE OF "THE CRAFT IN DANGER." (From *Kay's Portraits.*)
Barclay, mounted on the elephant, is attempting to enter the University. The other figures, from the left, are Gregory, Hope, Monro (*tertius*), Jameson (Natural History), and Mr R. Johnston (a member of the Town Council).

article on "Anatomy" in the seventh and eighth editions of the *Encyclopædia Britannica*, and taught Anatomy in No. 3 Surgeon Square from 1818 to 1822; Dr Craigie had followed Dr Smith, of whom little is known, but neither of them had much success as a teacher. Craigie became Inspector of Anatomy for Scotland in 1832 under the new Anatomy Act.

One of Barclay's demonstrators was Robert Liston who, having disagreed with Barclay, began to teach anatomy on his own account with James Syme as his demonstrator, to a class of sixty students in the winter session 1818-1819. The class-room was in Surgeon Square, but at what number I have been unable to discover. Here Liston and Syme carried on the class between them for several years with increasing success, Syme eventually taking over the management. They

taught both anatomy and surgery on the lines introduced by the Bells; and at a later date, in 1829, William Fergusson as Knox's demonstrator began a course on surgical anatomy which proved exceedingly popular with the students.[37]

Another successful lecturer was William Cullen (grand-nephew of the celebrated William Cullen) who lectured in John Bell's old class-room in Surgeon Square to about a hundred students, moving later (1825) to an anatomical school in "Society," Brown Square, where he succeeded James Syme who had lectured there for one year on anatomy. Cullen died after five years as a teacher in 1828. Mr Lizars had been teaching anatomy and surgery at No. 1 Surgeon Square, and on the death of Cullen he moved to the Brown Square School (now the south corner of Chambers Street and George IV. Bridge).

It should be remembered that up to this time the students as a general rule did no individual dissection. A few favoured or enthusiastic spirits helped the anatomical teachers to prepare for their demonstrations; but the material available did not permit of universal practical dissection. Instruction was conveyed by lecture-demonstrations, of which one winter's course was compulsory, and of which almost all students took two courses. Preparations ready dissected were also available for reading. To facilitate reading and to supply the dearth of material there was a great output of plates, tables, and coloured illustrations by the various teachers and their assistants. Among these the text-books of John Innes and Andrew Fyfe, who acted successively as prosecutors or "dissectors" to Monro *secundus*, were in great demand, and may still be seen occasionally on second-hand book-stalls. There was in them avowedly nothing new but they frequently display considerable merit in draughtsmanship, and the same hands illustrated the scientific works of Monro *secundus* and other teachers. Fyfe's *System of Anatomy* (published in 1800) is especially worthy of note. It contained 160 plates and about 700 figures, mostly reduced from the works of continental anatomists and some from his own dissections, the drawing and engraving being the work of his own hand and displaying a great degree of skill. John Aitken, who entered the College of Surgeons as a Fellow in 1770, and apparently conducted coach-classes on most of the subjects in the medical curriculum—anatomy, surgery, midwifery, chemistry, and practice of physic, had published in 1786 an elaborate

System of Anatomical Tables with Explanations.[38] The works of the Monros, of John and Charles Bell, and of Gordon have been already mentioned. Charles Bell also introduced another form of teaching apparatus, of which many examples may still be seen in the Museum of the Royal College of Surgeons. Clemente Susini and his pupils at Florence had introduced the making of exquisite wax models of dissections. Charles Bell copied the process by making plaster casts which he covered with a thin layer of variously coloured wax, moulded as it dripped from candles of the colours required.

Andrew Bell, a professional engraver, produced a number of collections of plates from 1777 to 1798, under various titles such as *Bell's Edition of the Plates of Albinus*, *Anatomical Engravings*, and *Anatomia Britannica*, and he was extensively employed by the anatomical teachers Edward Mitchell, another engraver, did the plates for Barclay's *Engravings of the Bones, etc.* (1819 and 1824); he copied largely from Sue and Albinus. Later editions of this work, and continuations dealing with the nerves (1829), arteries (1831), muscles (1832), and ligaments (1834) were published under the superintendence of Robert Knox (the arteries under that of Wharton Jones), and were generally known as *Knox's Plates.* Another highly popular *System of Anatomical Plates*, in five folio volumes, was issued by John Lizars from 1823 to 1826. All these plates by the various teachers were copied from or based upon the works of Albinus, Haller, Camper, Scarpa, Soemmering, Walther, Cloquet, Tiedemann, etc., and the great output in Edinburgh at this time is explained in the preface to Knox's work that they were to be used as a guide in dissecting, which was now becoming more prevalent among students, though not compulsory till 1826. Knox says, "the experiment was eminently successful; and it was easy to observe that, by the use of such delineations and descriptions in the practical rooms, the general character of the dissections shortly became altogether different."[39]

The College of Surgeons from very early times had been interested in rarities of natural history, and even in Monteath's time (1694) there had been a semblance of a museum containing among other things "ane egyle," "three scorpions and a chameleon," "an allegatory or young crocodile," and later "a strange creature called ourang-outang."[40] In 1702 Pitcairne presented to the College a body showing an elaborate dissection

of the muscles, still preserved though sadly gnawed by the tooth of time; and in 1718 Monro *primus* presented a skeleton (still preserved) and other specimens. Specimens of normal and pathological anatomy gradually accumulated, and at the end of the eighteenth century Barclay commenced his valuable collection of pathological and comparative anatomy, which on his death became the property of the College. With this nucleus, the College, sometime about 1820, conceived an ambitious scheme of purchasing a high-class anatomical museum. An attempt was first made to secure that of Professor Meckel of Halle, and on this proving ineffectual Dr Cullen was sent to Paris in 1823 to secure a steady supply of specimens. He met with partial success only, and the College finally, in July 1825, purchased for £3000 the museum of Charles Bell who was about to retire from teaching anatomy in the Windmill Street School, London. The arrangements for the transfer were superintended by Dr Robert Knox, Conservator of the College Museum, and one perceives from a perusal of the Minute Book of the Curators of the College that Knox displayed an enormous amount of enthusiasm and labour in the foundation of this anatomical museum, which has become in importance second only to the Hunterian Museum in London.

DISSECTIONS PRESENTED TO THE R.C.S. MUSEUM BY MONRO (*primus*) IN 1718 AND A. PITCAIRN IN 1702.
(*Photo by* D. M. GREIG, Esq., F.R.C.S.)

When Barclay retired in 1824, Knox took over his class and lecture room at No. 10 Surgeon Square, and quickly became the most popular anatomical teacher in Edinburgh. When he had been lecturing four years his class numbered over 500,

probably the largest anatomical class that has ever assembled in Britain. Although most of its members were medical students, Knox also attracted to his lectures barristers, scholars, clergymen, noblemen, artists, and men of letters; indeed he went far to make anatomy a pursuit of fashion, as Galen's lectures had been at the court of Marcus Aurelius. Probably this very popularity, by associating his name especially with anatomy, was the means of turning against him more than against any of the other teachers the odium of the public, following on the Burke and Hare exposures. As generally known, Burke and Hare were two debased Irishmen resident in Edinburgh, who conceived a scheme of supplying bodies for the dissecting rooms at less trouble and danger to themselves than could be effected by the methods of body-snatching commonly followed by the "Resurrectionists" of the time. Their method was to entice friendless people into their house in the West Port, stupefy them with drink, and thereafter suffocate them and sell the bodies to the porters of the various anatomy rooms. At least sixteen people were thus done to death before Burke and Hare were apprehended and tried in December 1828. The last of these bodies was found in Knox's rooms, and popular animus was therefore naturally directed first at him. Yet Lord Cockburn, commenting upon the affair in the *Memorials of his Time*, writes: "All our anatomists incurred a most unjust and very alarming, though not an unnatural odium; Dr Knox in particular, against whom not only the anger of the populace, but the condemnation of more intelligent persons, was specially directed. But tried in reference to the invariable and the necessary practice of the profession, our anatomists were spotlessly correct, and Knox the most correct of them all."[41]

SKETCH OF DR R. KNOX.
Made in the class of 1834-35, by Edward Forbes, the naturalist.

Although the students remained by Knox for years and showed him many examples of their affection and regard, his ability both as a teacher and investigator declined, and in 1845 he left Edinburgh for practice in London. Teaching had been Knox's

forte, and his lectures were studied and rehearsed with the utmost care, even down to his dress and jewellery. He had an extraordinary power of lucid exposition, as one may still perceive from his writings, and he appears to have infused an interest into the dull facts of anatomy partly by his caustic wit and partly by a constant reference to the structure and functions of the parts he happened to be describing, as they existed in the lower animals. He published numerous short papers on circumscribed anatomical subjects, and longer works, such as *The Races of Men*, *A Manual of Artistic Anatomy*, *A Manual of Human Anatomy*, etc., all of ephemeral interest as regards their subject, but striking for the lucidity and force of their descriptive power.[42]

The years between 1828 and 1831 mark a definite stage in the history of anatomical instruction. The College of Surgeons had made a course of three months practical anatomy compulsory for its students after March 1826, and the University followed in the next year. These exactments by pressure on the already restricted material for dissection led to an increase of "Resurrectionist" activity, incidentally were indirectly responsible for the Burke and Hare atrocities, and so led ultimately to the Anatomy Act of 1830. This regulation, which made body-snatching unnecessary and useless, had long been craved by teachers in all the medical schools of Britain. In 1828 the College made attendance on two courses of anatomy compulsory, and in 1829 the practical anatomy course was extended from three to six months, to be again extended to twelve months in 1838. In 1831 the University separated the Chair of Surgery from that of Anatomy, producing a necessary change in the scope of the anatomy lectures. This had been agitated by the College of Surgeons since 1772, but being bitterly opposed by Monro *secundus* at that time as an infringement of his rights, the separation could not then be effected. From this year—1831—anatomical instruction entered upon the modern epoch in Edinburgh.

In conclusion the writer desires to express his indebtedness to the Council of the Royal College of Surgeons of Edinburgh for their kindness in making the portraits, museum, and records of the College freely available to him for the purposes of this article.

[An abstract of this Paper was read at the International Congress of History of Medicine, London, July 1922.]

REFERENCES.

[1] A Collection of Royal Grants and other Documents relative to the Constitution and Privileges of the Royal College of Surgeons of Edinburgh, Edinburgh, 1818.

[2] List of Fellows of the Royal College of Surgeons of Edinburgh, Edinburgh, 1874, p. 3.

[3] *Dict. Nat. Biog.*, Article: Blackwood, Henry.

[4] *Ibid.*, Article: "Duncan, Mark." Also Hill Burton's *The Scot Abroad*, p. 115.

[5] *The Whole Art of Chyrurgerie*, P. Lowe, 1597.

[6] *Life of Jerome Cardan*, H. Morley, London, 1854, p. 77.

[7] "Inventaires de la Royne Descosse," Bannatyne Club, 1863, p. lxiii. Also "Sketch of the Early History of the Medical Profession in Edinburgh," John Gairdner, Edinburgh, 1864.

[8] "Note on the Incorporation of Surgeons and Barbers," Scott Moncrieff, *Edin. Med. Journ.*, Dec. 1912.

[9] Records of the College of Surgeons, 20th March 1645.

[10] *Works of Alexander Pennecuik*, Leith, 1815, p. 2.

[11] Records of the College of Surgeons, 26th Sept. 1591 and 15th July 1647.

[12] *Ibid.*, 18th May and 26th May 1669.

[13] "Historical Sketch of the Royal College of Surgeons of Edinburgh," John Gairdner, Edinburgh, 1860, p. 16.

[14] *History of the University of Edinburgh*, by A. Bower, 1817, vol. ii., p. 148.

[15] "The Royal College of Surgeons: Anatomy in the Early Days," C. H. Cresswell, *Edin. Med. Journ.*, 1914, p. 144.

[16] *The Edinburgh Anatomical School*, J. Struthers, Edinburgh, 1867, p. 11.

[17] *Ibid.*, p. 14.

[18] Bower, *op. cit.*, vol. ii., p. 163.

[19] *Ibid.*, vol. ii., p. 182.

[20] *Ibid.*, vol. ii., p. 183.

[21] Cresswell, *loc. cit.*, p. 150.

[22] Works of Alexander Monro, published by his son, Edinburgh 1781.

[23] Struthers, *op. cit.*, p. 23.

[24] Monro's *Observations, Anatomical and Physiological*, 1758, p. 27.

[25] Monro's *Structure and Physiology of Fishes*, 1785, p. 39.

[26] Monro's *The Brain, the Eye, and the Ear*, 1797, p. 9.

[27] Works of Robert Whytt, 1768, p. 728.

[28] *Soemmerring Cyclopædia of Anatomy*, vol. i., p. 466.

[29] "Edinburgh University: A Sketch of its Life for Three Hundred Years," Edinburgh, 1884. Quoted in *The Edinburgh School of Surgery*, Alexander Miles, London, 1918, p. 84.

[30] *Letters on the Education of a Surgeon*, J. Bell, Edinburgh, 1810, p. 579.

[31] *Ibid.*, pp. ix. and 503.

[32] Whytt, *op. cit.*, p. 324.

[33] Struthers, *op. cit.*, p. 54.

[34] "Some of the Older Schools of Anatomy connected with the Royal College of Surgeons, Edinburgh," C. W. Cathcart, *Edin. Med. Journ.*, March 1882.

[35] *Life of John Barclay*, Sir G. Ballingal, Edinburgh, 1827.

[36] *A Series of Original Portraits and Caricature Etchings*, John Kay, Edinburgh, 1837, vol. i., p. 448.

[37] Miles, *op. cit.*, p. 134.

[38] Struthers, *op. cit.*, p. 38.

[39] Engravings of the Arteries with Explanatory Reference by Dr Knox, 1831, preface.

[40] Miles, *op. cit.*, p. 15.

[41] *Memorials of his Time*, Henry Cockburn, Edinburgh, 1856, p. 257.

[42] *Life and Writings of Robert Knox*, Lonsdale, London, 1870.

AN OLD-TIME REMINISCENCE OF TRENCH FOOT.

Crimea, 1854-55.

By DAVID M. GREIG, C.M., F.R.C.S.E., Conservator, Royal College of Surgeons' Museum, Edinburgh.

In the just-issued official History of the Great War[1] there is a chapter on trench foot by Colonel H. W. Gratton, A.M.S. Reference is made to the mention of frost-bite in the Army by Xenophon, to the description of frost-bite by Baron Larrey in Napoleon's Russian campaign, and to its occurrence during the Crimean War. Most of these, however, were undoubtedly examples of true frost-bite, and from them that form of gangrene of the extremities not necessarily associated with a temperature below freezing-point was only occasionally differentiated, though in the Crimean War such appreciation of difference was almost reached, for the surgeons of that day stated,[2] "It was not, however, noticed that a low range of temperature exclusively determined the existence of this affection" (*i.e.* frost-bite). It was only in the recent Great War that it acquired the distinctive appellation of "trench-foot." This affection, moreover, is one for the elucidation of which the Edinburgh school of pathologists has done so much.[3] Under such circumstances the following case may not be uninteresting nor uninstructive. I have transcribed it verbatim from the private note-book of the late Dr David Greig, F.R.C.S.E., sometime Assistant Surgeon, 17th Regiment H.M. Army in the Crimea.

"Mathew Raidy, aged 20, a native of Co. Kilkenny, Private, 30th Regiment—eight months in the Service. Is a strong young fellow and arrived in the Crimea on the 1st September 1854. Was engaged at the siege of Sevastopol and continued in good health until the 20th December, when he was admitted into the Camp Hospital suffering from diarrhœa. Before this he had been much exposed while working in the trenches. Was three days in hospital when his feet became very sore and—as he describes it—his toes became discoloured and small blisters appeared on them. He can give very little more account of the progress of this disease. He was put on board ship at Balaclava on the 4th January 1855, and was landed and admitted into Coolalie Hospital on the 10th January. On admission into hospital he had no diarrhœa, but the toes of both feet are quite gangrenous. The gangrene extends up the right foot as far as the base of the metatarsal bones and somewhat further on the outside

where a line of demarcation is forming; there is dark vesication, however, extending up the dorsum of the foot. On the left foot the toes are black and hard and this seems to be extending. The patient was put on half diet and wine; soothing applications were applied to the feet and I saw no more of him until the 17th when Dr O'Connor, 1st class Staff Surgeon, called me into consultation concerning this patient.

I found him in a pretty good state of health, in good spirits, tongue clean, bowels regular. The line of demarcation is now well formed on the right foot, the skin is peeling off the back of the foot and also the front of the ankle, but healthy tissue is seen below. The left foot is black for about half an inch beyond the roots of the toes but a line of demarcation is not yet formed. I recommended amputation at ankle joint on the right foot and the postponement of any interference at present with the left. Dr O'Connor said I might try that operation if I liked, the other three (Drs Salter, Temple, and Grantt) objected to it. I was determined however, and on the 18th, assisted by the others, I performed amputation at the ankle joint. The operation was very satisfactory. Considerable difficulty was experienced in tying the sutures, the cut tibial and internal plantar were easily got hold of and secured, and there was a general oozing from the rest of the flap which ceased (almost) by sponging with cold water. Three sutures were put in and dry lint and a bandage applied. He took some food and slept three hours before the evening visit.

Vesper.—No bleeding; to protect the stump from pressure by the bed-clothes it was put in a shako padded with tow.

19th.—Feels very well—bowels open—pulse 80; takes his food well—stump easy—continue dressing left foot with a soothing liniment.

Vesper.—Suppuration seems to have commenced—pulse 104. Feels comfortable and inclined to sleep.

This case did very well. In six months he was walking about and was sent home invalided to Chatham. With regard to the left foot the toes were allowed to drop off. I then removed the heads of the metatarsal bones with the plyers and altogether it made a very good stump.

Remarks.—I believe this was the first case of amputation at the ankle joint ever performed in Turkey. The saving of the left foot was a great matter here as the patient could balance his body better and stand steadier than if both had been amputated at the ankle."

The late Sir William Aitken, sometime Professor of Pathology in the Army Medical School at Netley, in a paper on the Health of the British Troops in Bulgaria and the Crimea,[4] gave the number of admissions for frost-bite as 1844, or 4·45 per cent. of total admissions, and stated that 20·85 per cent. of these died. His paper is written for the purpose of pointing

out what weakening effect other diseases, such as malaria from residence in Bulgaria, may have on the soldier. The initial diarrhœa in the case above quoted may therefore not be without some significance. The time of year is that of the incidence of trench foot, and the conditions of service were somewhat analogous to those of the stalemate in Flanders. I remember the author telling me—doubtless with this case in his mind—that Syme's amputation was unknown to the army surgeons he came in contact with at that time; that to explain what he proposed to do he took them to the mortuary and demonstrated the procedure and was told that that operation was all very well on the cadaver but had no place in practical surgery! One can appreciate even to-day the judgment which advised delay and through which the other foot escaped a radical operation, for in Colonel Gratton's article referred to it is written (p. 176), "In cases of apparent gangrene of the foot it is never right to amputate at once, for in the majority of such cases the foot recovers. If the gangrene is dry, it is well to wait for a 'line of demarcation,' but if moist it is often necessary to amputate earlier. In very few cases is an amputation through the leg required. Syme's amputation can generally be performed, even in the worst cases."

REFERENCES.—[1] *Official History of the War. Medical Services. Surgery of the War*, vol. i., p. 169, London, 1922. [2] *Medical and Surgical History of the British Army which served in Turkey and the Crimea during the War against Russia in the years* 1854-55-56, vol. ii., p. 187, London, 1858. [3] Lorrain Smith, J., Ritchie, J., and Dawson, J., "On the Pathology of Trench Frost-bite," *Lancet*, vol. ii., p. 595, London, 1915. [4] Aitken, W., "On the Effects of Twelve Weeks' Residence in Bulgaria (during the months of June, July, and August, 1854) on the Subsequent Health of the British Troops in the Crimea," *Med. Chir. Trans.*, vol. xl., p. 179, London, 1857.

CLINICAL RECORDS

CHRONIC INTERSTITIAL NEPHRITIS IN CHILDHOOD: RENAL INFANTILISM (?).

A Clinical Record with Post-Mortem Report.

By H. L. WATSON-WEMYSS, M.D. F.R.C.P. (Ed.).

Attention has recently been directed to a type of infantilism associated with chronic interstitial changes in the kidneys. I had the opportunity of observing a patient displaying this condition in a very marked degree for a period of fourteen months; and the rarity of the condition, together with the many points of exceptional interest which the patient exhibited, seem to warrant a detailed description of the clinical course and post-mortem findings.

Case.—In November 1920, a girl (M. T.) aged 9 was admitted to Leith Hospital under my care. She complained of severe headaches and vomiting of about five or six months' duration.

For her years an eventful medical history was obtained. Born at full time and healthy till the age of two years, she was subsequently never strong. At the age of two she began to show marked evidence of rickets. She had a mild attack of diphtheria when three years old, and one year later a double osteotomy was performed for genu varum in the Sick Children's Hospital. She had also had tonsils and adenoids removed and was stated to have suffered from whooping-cough, pleurisy, bronchitis, and a cellulitis of the leg.

Family History.—The father and mother were alive and healthy. Three other children were in good health: one died at two months from pulmonary disease. There had been one miscarriage.

Present Illness.—The symptoms, headache and vomiting, which began in July 1920, had been very much more severe during the two months preceding admission. At first only occurring in the morning, they were now more frequent. The mother stated that for about three years she had noticed that the child always seemed thirsty and polyuria had also been noted during that period.

On Admission the child was found to be undersized and of stunted growth. She weighed 39 lb. and was 3 ft. 6 in. in height. She was pale and emaciated. Her intellectual development was that of a child of about six years.

A few hours after admission she had an epileptiform attack and passed from one fit into another. On recovering consciousness it was

noticed that her hands had assumed the position characteristic of tetany. This phenomenon was frequently observed afterwards in the absence of fits, but was always associated with attacks of headache and vomiting. The heart showed definite hypertrophy, the apex beat being half an inch external to the left mid-clavicular line in the 5th intercostal space. The sounds were pure but the 2nd aortic sound was loud and slapping. The peripheral vessels were readily palpable and the pulse incompressible. The systolic blood-pressure was 204 mm. Hg.

The lungs showed no abnormality.

The urine was neutral in reaction: the sp. gr. was 1014 and a moderate amount of albumen was present, together with a large quantity of acetone. The average daily quantity excreted was rather small. At no time were any casts found, even after repeated and careful search.

A few weeks after admission the urine began to show large quantities of blood, and excepting short periods during which it was absent, blood was present until the death of the patient.

I am indebted to Dr Cameron for his report on the eyes. On admission the left fundus showed definite retinitis, and a similar condition was present on the right side in an earlier stage. Dr Cameron stated that the retinitis was of albuminuric type: he frequently examined the patient subsequently, and the condition grew gradually worse until an intense neuro-retinitis was present in both eyes with many large hæmorrhages.

The diagnosis of chronic interstitial nephritis with uræmic attacks was reached, and an attempt was made to estimate the functional efficiency of the kidneys.

The diastatic activity of the urine was within normal limits (d = 10).

The estimation of the total non-protein nitrogen of the blood, the urea nitrogen and the chlorides gave the following figures:—

Total non-protein N. .	.	=	36 mgm. per cent.
Urea N.	.	=	15·3 ,, ,,
NaCl.	.	=	0·737 ,, ,,

These figures, in no way very striking, were obtained during an interval between the uræmic attacks. It is possible that during an attack a greater departure from the normal would have been found.

In a review of this subject in normal children, Tileston and Comfort[10] conclude that the average figure for the non-protein nitrogen is from 24-26 mgm. per cent., and for the urea nitrogen from 9-11 mgm. per cent.

The patient improved considerably with rest and a diet poor in protein, while the headaches and vomiting became less frequent. She was at length discharged in March 1921 and continued attending the

out-patient department of the hospital. She was, however, very shortly readmitted with a recrudescence of the symptoms and remained in hospital until October 1921. The blood-pressure never fell below 180. The urine usually contained blood in large quantity, but it was remarkable what a long period elapsed before severe anæmia set in. Her final admission to hospital was on the 4th January 1922. She was brought up with the history of a convulsion on the previous day, and it was obvious that the right side of the face was paralysed.

She was now very obviously anæmic. Her height and weight were practically the same as a year previously.

The blood pressure was now the remarkable figure of 240 mm. Hg.

Examination of the blood gave the following figures:—

R.B.Cs.	1,590,000.
Hb.	30 per cent.
W.B.Cs.	26,000.

This was a polymorph leucocytosis and was apparently due to the fact that the patient had at this time a staphylococcal abscess on the abdominal wall and also a septic arthritis of the left shoulder joint which followed on a small subungual whitlow.

The child gradually grew weaker and died on the 1st February 1922, without the occurrence of any further convulsions.

Unfortunately permission was only granted for a partial autopsy.

I am indebted to Dr Andrew Rutherford, Pathologist to the Leith Hospital, for the following account of the organs examined.

Hæmatin and Eosin were used in the preparation of all microscopical sections.

Kidneys.—Weight = R. 47 gm.; L. 22.5 gm. Both kidneys are reduced in size and very greatly altered in appearance. The capsules strip with some difficulty. The surface is rather coarsely irregular and mottled, reddish and pale yellowish areas alternating. These pale areas project, and between them are fibro-vascular puckered depressions. The external surface of both kidneys is thus notably irregular and nodular.

On section the outline is irregular and the cortex varies much in width at different parts. It shows a pale yellowish background with the ordinary markings obliterated and replaced by tiny areas of congestion and red points in the paler tissue. Larger blood-vessels are thickened and stand out. The renal pelvis shows one or two ecchymotic patches. Microscopically the appearances are typically those of the arterio-sclerotic kidney. The cortex shows areas of marked interstitial fibrosis of varying age alternating with patches where the convoluted tubules are irregularly dilated, their epithelium degenerated and their lumina filled with granular or colloid-like contents.

At places the glomeruli are bunched together and all of them replaced by fibrous knots. Elsewhere some glomeruli show various degrees of chronic fibrotic change, but for the most part they exhibit increase of connective tissue nuclei with swelling of the capillary walls within the tufts. Apart from the densely fibrotic areas, there is a general interstitial fibrous increase, in parts fairly cellular.

Vascular changes are marked, there being general intimal and medial thickening of the smaller blood-vessels and a more patchy atheromatous change in the larger.

Heart and Aorta.—The heart is somewhat enlarged transversely. There is no pericarditis. There is very definite and marked hypertrophy of the wall of the left ventricle with one or two atheromatous patches on the anterior cusp of the mitral valve and at the root of the aorta in the sinuses of Valsalva. The endocardium of the left auricle is thickened and shows several subendocardial ecchymoses.

Microscopically many muscle fibres show increased thickness. There is no interstitial fibrosis. The Aorta shows throughout a considerable amount of early atheromatous patching. Microscopically a marked nodular atheromatous change is evident in the intima without any degeneration in the deeper parts. The media is thickened and shows many streaks staining faintly with hæmatin and lying parallel to the muscle fibres—possibly early calcification.

Liver.—The liver is pale and slightly congested.

Microscopically there is slight congestion of the sinusoids immediately surrounding the central vein and some increased granularity of the liver cells in this region. There is also a fair amount of fatty vacuolation in the peripheral parts of the lobules.

Suprarenals.—The right suprarenal is notably enlarged. Both organs show patches of congestion in the cortex.

Microscopically, in the case of the supra-renals, spleen and pancreas, no notable change is evident except in the blood-vessels. All the smaller vessels show very marked hyaline degeneration in the middle coats, while the larger vessels show nodular atheroma.

It is generally admitted that chronic interstitial nephritis in childhood is one of the rarities of medicine. In 1903 Sawyer [1] could collect only 24 cases from the literature. Heubner [2] characterises it as "ein sehr seltener Krankheit," and more recently Griffith [3] expresses the same view.

The occurrence in early childhood of a disease commonly associated with middle age and the physical and mental stress of a busy life has not been explained. Congenital syphilis, lead-poisoning, alcoholism in the parents, the exanthemata, have all been blamed, apparently on quite insufficient evidence.

Heubner believes that contracted kidneys may follow an acute nephritis and cites the case of a patient aged 18, with a history of acute nephritis four years previously. It would appear, however, that in some instances the disease may be intra-uterine in its development and there is evidence to show that it may even be congenital. In this connection Hellendall's[4] remarkable cases are of great interest. He related the occurrence of contracted kidneys (confirmed by autopsy) in two children, aged two years and six months respectively, whose mother suffered clinically from the same affection, her symptoms commencing during the intra-uterine life of the elder child. Förster[5] also records 2 cases in the same family and notes a superficial clinical resemblance to diabetes insipidus.

Recently the tendency has been to regard the condition as a variety of infantilism and the subject has been reviewed by Barber[6] under the title of Renal Dwarfism. His definition is "a condition of stunted development associated with bone deformities of the late rickets type, due to an insidious chronic interstitial nephritis of obscure ætiology." While the case of M. T. must, I think, be regarded as a type of infantilism, it differs from Barber's description in the more youthful age of the patient, the earlier development of rickets, and in the profound cardio-vascular changes. In the majority of Barber's cases the cardio-vascular system was little, if at all involved, and the systolic blood-pressure was from 100-110 mm. Hg.

Our literature is still very far from rich in investigations of the blood-pressure in children. The researches of Judson and Nicolson[7] show that a systolic pressure of 95-100 mm. Hg. may be taken approximately, as the normal level for a child of 9 or 10 years old.

Gordon[8] found a marked rise in pressure in nephritic children, his highest reading being 180 mm. Hg. in a case of acute nephritis. In chronic nephritis, on the other hand, he only records as his maximum the modest figure of 124 mm. Hg.

More recently Berkeley and Lee[9] have analysed a series of 93 cases of chronic nephritis in children from the records of the Massachusetts General Hospital. One of these cases was a boy aged 10, with a systolic pressure of 250 mm. Hg., and showing also retinitis, an enlarged heart, and albuminous urine.

It is unfortunate that no mention is made of the size of

the armlet used, the importance of which was long ago emphasised by von Recklinghausen.

In the estimations carried out in the case under review, a Riva Rocci instrument was used with a 12 cm. armlet, and the finger readings were always checked by the auscultatory method. There is no doubt that the sudden rise of pressure from about 200 mm. Hg. to 240 mm. Hg. resulted in a cerebral hæmorrhage which caused the facial paresis.

Retinitis is undoubtedly rare, but probably has often not been sought for. In addition to the case recorded by Berkeley and Lee, Heubner mentions retinitis in a girl of 2½ years.

REFERENCES.—[1] Sawyer, *Birm. Med. Rev.*, 1903, vol. liii.-liv., p. 511. [2] Heubner, O., *Lehr. d. Kinderhlk.*, 1906, vol. ii. [3] Griffith, *Dis. of Infants and Children*, 1919, London and Philadelphia. [4] Hellendall, *Arch. f. Kinderhlk.*, 1897, vol. xxii., p. 61. [5] Förster, *Jahrb. f. Kinderhlk.*, vol. xxvi., p. 38. [6] Barber, Hugh, *Quart. Med. Journ.*, 1921, vol. xiv., p. 205. [7] Judson and Nicolson, *Amer. Journ. Dis. Child.*, 1914, vol. viii., p. 257. [8] Gordon, Lennox, *Arch. Pediat.*, 1911, vol. xxviii., p. 343. [9] Berkeley and Lee, *Amer. Journ. Dis. Child.*, 1917, vol. xiii., p. 354. [10] Tileston and Comfort, *Amer. Journ. Dis. Child.*, 1915, vol. x., p. 278.

A CASE OF SOLITARY CYST IN THE HUMERUS (*OSTEITIS FIBROSA CYSTICA*).

By K. PATERSON BROWN, M.B., F.R.C.S.E.

(*From Mr Alexander Miles's Clinic.*)

THE comparative rarity of this condition, and the importance of differentiating it from other bone conditions which, clinically, are very similar, but have a more serious outlook, warrants the publication of these notes.

CASE.—Mrs G., age 28, was sent to the Royal Infirmary by Dr Henderson of Newmills, Fife, suffering from a fracture at the lower end of the humerus. The patient, a pale, unhealthy-looking Irish woman, gave the following history. Towards the end of October 1921 she was confined to bed for three days suffering from what she describes as a "cold." She did not call in her doctor, and was soon going about again feeling perfectly well. A few weeks later the patient began to experience an aching sensation which radiated from the lower part of the humerus up to the shoulder. This ache, which never amounted to true pain, only occurred at irregular intervals and seemed to be aggravated by cold. There was a feeling of weight at the elbow but no interference with function, the patient being quite able to fulfil all her household duties. About the beginning of June 1922, while patient was stretching up with her left arm to remove some clothes hanging from a rope above her head, she felt her arm give a sudden crack, experienced severe pain, and was unable to use the arm.

A fracture of the humerus was diagnosed and appropriately treated, but a fortnight later as the condition did not appear to be progressing normally, she was sent into hospital for radiographic examination.

The patient stated that she had always been perfectly healthy, with the exception of whooping-cough and measles as a child she had had no illness. There had been no previous fractures. On admission there was slight pyorrhœa alveolaris, but no other septic focus could be discovered. The Wassermann test was negative. An examination of the urine revealed nothing. Patient had two children, aged 6 and 2 respectively; both were perfectly healthy. So far as could be ascertained by questioning the patient, no other member of the family had suffered from a similar condition.

On examining the left arm a distinct fusiform swelling, some $2\frac{1}{2}$ in. in length, could be felt at the lower third of the humerus. The swelling was hard and smooth in outline except at its upper end, where an irregularity and slight lateral movement was made out. No egg-shell crackling could be elicited. X-ray examination revealed a

cystic area in the centre of the bone with partial destruction of the compact bone and a fracture through this weakened area. The remainder of the shaft showed no change from the normal. Radiographs of the right humerus, the femora and the tibiæ showed nothing abnormal.

Operation (Mr Miles).—A postero-external incision was made over the swelling. The periosteum exposed, was normal in appearance, but partially separated from the expanded area of bone. On further separation of the periosteum it was found that the underlying bone which formed the cyst wall was soft and could easily be gouged out, exposing the bone cavity filled with a pink gelatinous material. This was completely removed by curetting, and the bony wall surrounding the cavity was found to be perfectly smooth. There being no undue hæmorrhage, the wound was closed.

Microscopical examination of the cyst contents reveals numerous spicules of bone surrounded by areas of cellular fibrous tissue, some of which are undergoing myxomatous degeneration. At one point a small area of hyaline cartilage is seen. No giant-cells can be found in the sections.

Comments.—From a study of the literature, it appears to be well established that a large proportion of bone cysts are closely related to osteitis fibrosa in its later stages. Cysts of the long bones are most frequently found in the humerus, femur, and tibia. In a classification of 97 cysts of bone by Silver, which Elmslie[1] quotes in a paper on this subject, 31 occurred in the femur, 25 in the humerus, and 15 in the tibia. They occur, as a rule, close to but not involving the epiphyseal cartilage, and as the bone grows they may move further towards the centre of the shaft. Elmslie assumes, therefore, that a cyst which is found close to the end of the bone is of recent origin. The lower end of the humerus is a rare site for these cysts; only two cases are recorded in the above-mentioned paper. Landon[2] states that they occur seven times at the upper end to once at the lower.

In a study of 89 cases of bone cysts, Bloodgood[3] divides them into two groups. *A*. True bone cysts with a definite relation to osteitis fibrosa, of which there were 69. *B*. Cysts in the medullary cavity due to other causes. Of these 69 cases, only in 5 was the age of onset over twenty years, and this agrees with the findings of other observers. Our case would appear to fall into this small group, though the possibility that the cyst has been present from adolescence without causing

symptoms, cannot be excluded. In a large proportion of cases the cyst is unsuspected until the routine radiographic examination of a superadded fracture reveals its presence, though pain and swelling may be so severe as to cause the patient to seek advice before spontaneous fracture occurs.

No satisfactory evidence has as yet been brought forward to explain the etiology of this condition. Many theories have been advanced, ranging from that of Virchow, who believed that the condition arose from liquefaction of a chondroma, to the more modern view that there is some disturbance of the endocrine glands. There is now no reason to believe that the primary lesion is a chondroma. Cartilage is usually seen microscopically, but when present it is only in small amount, and in some cases it is entirely absent. Some observers believe the condition to be inflammatory in origin. In only a few cases, however, have organisms been obtained from the bone lesions. De Courcy [4] reports a case of a cyst occurring in the humerus of a boy following on a very severe vaccination reaction ten months previously. He suggests this as a cause for the lesion. Lewis [5] quotes Rehn's work on snuffles in pigs, which showed that changes in the facial and nasal bones observed in animals suffering from this disease are very similar to those observed in fibrous osteitis in man. In pigs the changes are apparently due to an inflammatory process starting about the teeth. Young and Cooperman [6] include benign bone cysts under the heading of osteitis fibrosa, and they consider that in its localised form trauma is an important factor, while in its generalised form there is a co-existing disturbance of the endocrine glands, and an interference with the general metabolism. Bland Sutton [7] states that benign cysts in bone may arise in consequence of the destruction of the red marrow by hæmorrhage into it, or from the spontaneous atrophy of the tissue of a myeloma. Ewing [8] believes that the cysts may either precede or be preceded by what he prefers to call a giant-cell sarcoma. The bone tissue is replaced by cellular fibrous tissue which may invade the marrow cavity replacing the red marrow. From this stage the disease takes one of two courses; the cellular tissue softens producing multiple bone cysts lined by fibrous tissue and filled with clear fluid, or in the walls of the cyst a giant-cell sarcoma develops. Many believe that trauma has an important bearing on the origin of this condition, especially, in its localised form, but from a study of the published cases,

RADIOGRAM OF SOLITARY CYST OF HUMERUS WITH SPONTANEOUS FRACTURE.

it seems more likely that the part that trauma plays is to draw attention to the lesion rather than to produce it.

Diagnosis.—The age incidence, the latency of symptoms, and frequently the occurrence of spontaneous fracture are all suggestive, and the X-ray characters will in most cases clinch the diagnosis. At operation it is usual to find that the periosteum is perfectly normal. The cyst contents are most frequently fluid, with or without the addition of solid masses, or they may be more gelatinous, as in our case. The solid or semi-solid material removed is not as a rule similar in appearance to that found in a myeloma, where the contents are chocolate- or liver-like in character. Microscopical examinations of the solid portions in the cyst correspond very closely to the findings in our case, and have caused considerable controversy as to the true nature of this condition. The presence of hyaline cartilage has already been noted as leading to erroneous views as to the origin of the cyst. The presence of giant-cells, not seen in our sections, has led to many of these cases being mistaken for sarcomata, but Bloodgood has conclusively proved that the presence of giant-cells cannot alone be taken as evidence of malignancy. He has long advocated the treatment by local curetting of giant-cell sarcomas, and his published results support his statements. Curetting of bone cysts is the simplest and most satisfactory line of treatment. The only serious complication that may arise is hæmorrhage, which, as a rule, can be controlled by firm packing, though Bloodgood reports two cases where death resulted from this complication.

REFERENCES.—[1] Elmslie, *Brit. Journ. of Surg.*, 1914, vol. ii., p. 17; *Brit. Med. Journ.*, 16th November 1912, p. 1367. [2] Landon, *Annals of Surg.*, 1914, vol. lx., p. 570. [3] Bloodgood, *Annals of Surg.*, 1910, vol. lii., p. 145. [4] De Courcy, *Journ. Amer. Med. Assoc.*, 1919, vol. lxxii., p. 1612. [5] Lewis, *Internat. Clin.*, 1918, vol. ii., p. 74. [6] Young and Cooperman, *Annals of Surg.*, 1922, vol. lxxv., p. 171. [7] Bland Sutton, *Tumours Innocent and Malignant*, 1922, p. 81. [8] Ewing, *Neoplastic Diseases*, 1922, p. 292.

OBITUARY

ALEXANDER CRUM BROWN, M.A., M.D. Edin.

F.R.C.P. Edin.; D.Sc. Lond.; LL.D. Aberd., Glas., Edin., St And.; F.R.S. Edin.; F.R.S. Lond.; Emeritus Professor of Chemistry, University of Edinburgh.

Emeritus Professor Crum Brown had been in poor health for some years during which time he had been unable to go out of doors. On Saturday, 28th October 1922, he passed peacefully to rest at his house, in Edinburgh. Although he had long passed the ordinary span of human life and many of his friends had predeceased him, a very large number followed with affectionate reverence to their resting place, the mortal remains of one whom they had so highly esteemed.

He was born in Edinburgh on 26th March 1838. His great-grandfather, Dr John Brown of Haddington, and his father, Dr John Brown of Broughton Place, were both distinguished theologians. His mother was the daughter of Alexander Crum of Thornliebank, Glasgow. Dr John Brown, M.D., author of *Rab and His Friends*, was his step-brother. He was educated at the Royal High School and Edinburgh University, where he graduated M.D. in 1861. His thesis was on "The Theory of Chemical Combination." At the time when Crum Brown studied, great advances were being made in Chemistry; the Atomic Theory was being developed. Possibly these were determining factors on the mind of the alert young student and led him to choose Chemistry as his life's work. He was at that time hopeful that it might be possible to form a mathematical theory of chemistry applicable to all cases of decomposition and recomposition. He went to Germany to study under Bunsen and Kolbe, and after his return to Edinburgh became an Extra-Mural Lecturer on Chemistry, and when Lyon Playfair resigned his Chair, Crum Brown was elected Professor of Chemistry. About that time, and for several years thereafter, the University Court was deeply moved by questions relating to the medical education of women. For a short time Crum Brown conducted separate classes for men and women, but this was too arduous and he discontinued his teaching of women. He was affectionately known among his students as "Crummie." He was not only distinguished in Chemistry but in all natural sciences, was fond of mathematics, and was a good linguist. He had special facility in French, German, and Italian, and had also some knowledge of other languages. It has been said that so wide and deep was his acquaintance with all kinds of knowledge that Crum Brown could have undertaken the teaching of any of the University Chairs.

In 1864 he was elected a Fellow of the Royal Society, Edinburgh;

for twenty-six years he acted as one of the Secretaries of that Society, and he served as Vice-President for the full term of six years. He was elected a Fellow of the Royal Society, London, in 1879.

Although he graduated M.D. he never practised either medicine or surgery, but he retained throughout his long life an active interest in the Science of Medicine. He characterised medical practice as a "Scientific Art," possessed an extensive knowledge of the natural sciences, and in a Graduation Address delivered in 1875 he indicated to the new graduates that no fact in anatomy, histology, or therapeutics is unimportant; that each individual case is a new problem requiring investigation for itself; that no amount of careless practice will produce skill; and that the qualities they should cultivate are honesty, truth, courage, modesty, kindliness. These are the very qualities which he possessed in a great measure along with a sympathetic nature, and he had also a wonderful faculty of finding the fundamentals of any proposition.

In an Inaugural Address which he delivered in 1896 to the Royal Medical Society, of which he had been one of the Annual Presidents, he emphasised the necessity for every practitioner of medicine to have a thorough practical training in Obstetrics. He also gave it as his experience that the beloved physician of most households is the General Practitioner.

In 1868 and 1869 Crum Brown, in conjunction with Dr Thos. R. Fraser, carried out an extensive series of observations, the results of which he communicated to the Royal Society of Edinburgh on the "Chemical Constitution in relation to the Physiological Action of various salts of the Ammonium Bases derived from Strychnia and other drugs." These papers were awarded the Macdougall Brisbane Biennial Prize. In 1874-5 he communicated papers "On the sense of rotation and the anatomy and physiology of the Semicircular Canals of the Internal Ear." For the elucidation of the function of these canals he made interesting experiments by means of a rotating table, ordinarily used for revolving lights. In 1881-2 he read a paper also before the Royal Society on a "Case of Dyspeptic Vertigo of some weeks' duration," and in 1895 "A Note on Normal Nystagmus." In the same year he delivered before the Oxford Junior Scientific Club a lecture on the "Relationship between the Movements of the Eyes and the Movements of the Head." Our space does not permit special notice of experiments with the phonograph and speaking bottle.

At the time of his death Crum Brown was the Senior Fellow on the Roll of Attendance of the Royal College of Physicians, Edinburgh. He took a deep interest in the work of the Edinburgh Medical Missionary Society, and from 1912 to 1917 his guidance as President of the Society was highly valued.

At social gatherings he was a charming member, he was a good raconteur of humorous stories. He was lenient in his judgments of others, and was never known to say an unkind word of anyone. He had such a wide and deep knowledge of science that in his life science and religion each supported the other. He was for thirty-five years a highly esteemed Office-Bearer of Eyre Place U.F. Church. He was a humble man because he was so great. He lived his religion, which appeared to be to do justly, to love mercy, and to walk humbly with God.

J. R.

LETTER FROM VIENNA.

(*From our own Correspondent.*)

SINCE my last letter conditions in Vienna have become steadily worse. By reason of strikes, which the leaders of the Social-Democrats, from whose hands the reins are slipping, can no longer prevent, though they themselves regard them as inopportune, means of communication have broken down, which causes great inconvenience in all business, noticeably in the daily work of the doctor. All the attempts of the Government to improve matters have led to nothing, so that the future outlook is cheerless in the extreme. With the value of the Austrian *krone* almost at zero, prices have reached a height, which even the ever-rising salaries and incomes do not balance. What use is it that almost every adult earns many million kroner a year, when a loaf costs 2000, an egg 400, and an inland letter 100 crowns? The chief preoccupation of the representatives of the medical profession here has been to secure from all officials and organisations as favourable conditions as possible, and in this they have succeeded to a large extent. The different *Krankencassen* which nowadays comprise almost the whole of a doctor's practice, have agreed that the fees and allowances paid to the medical men shall automatically rise along with the rising cost of living, as has for a long time been the case in other callings. Taxation, and the cost of telephones, have also been to some extent lightened. Some gleams of light are however apparent: for example, in connection with legal proceedings it has hitherto been the custom to require the attendance of a medical man without any reference to the necessities of his profession, and if he were not punctual he was liable to fine. Many magistrates now are showing much more consideration and allowing medical men to appear, within limits, at hours which suit them. It is generally desired that this practice will spread. A straw which shows how the wind blows, and indicates the greater friendliness of the

government to the doctors, is the increasing frequency with which the titles of Medicinalrath, Obermedicinalrath, Regierungsrath, and Hofrath, are bestowed.

Many questions of overwhelming importance to the profession remain to be settled, as, for example, Old Age and Infirmity Insurance, matters which are new in themselves, and which will require such colossal expenditure that their realisation is yet far distant. Nevertheless the preliminary steps have already been undertaken. Notwithstanding their other cares the whole medical profession is occupied with the consideration of the reform of the medical curriculum. It has for long been realised that the education of the medical student in Vienna, and indeed in all the other large schools, is inadequate as regards the practical subjects, and various schemes have been evolved to overcome this defect. One such, the restriction of the number of students, would have been effective, and was agreed to by the Medical Faculty of the University, but never came into force on account of the opposition of the Minister of Education, a Social-Democrat Board School teacher. Another proposal, which would equally have a good effect in this respect—the lengthening of the curriculum by one to two years, seems impracticable on the ground of the additional expense thrown on the student and his parents. The same difficulty stands in the way of any large increase in the staff and equipment for teaching. There would appear, therefore, to be only one way out of the impasse: a shortening of the time spent at school, and the introduction of two years of preliminary study. The course at the Austrian Gymnasia consists of eight years, of which the last seems quite superfluous, as nothing new is taught during it. If this could be taken off and added to the medical course, the desired additional semesters could be obtained without adding to the expense of the degree. To this proposal, however, the teachers of the humanities are strongly opposed, as they do not wish to sacrifice any part of the time given up to Latin and Greek. It is therefore more than doubtful whether the carefully-thought-out scheme based on such a shortening of the general education, and on a diminution of the time given to vacation, will lead to any result.

NEW BOOKS

Life of Sir T. P. Anderson Stuart, M.D. By William Epps. Sydney: Angus & Robertson, Ltd. 1922.

Many of the class-mates of Thomas Anderson Stuart during the late seventies may recall the tall, well-built, good-looking youth, who almost invariably carried off the class medals and who graduated at the University of Edinburgh in 1880 as the Ettles Scholar. The history of his achievements in life has been set forth by Mr William Epps, the Secretary of the Royal Prince Alfred Hospital, Sydney, and his intimate friend for many years, in a volume, which is not only a record of Anderson Stuart's life, but an historical account of the foundation and growth of the Medical School of Sydney, with which he was so intimately associated. It was largely owing to his powers of organisation, his enthusiasm and his driving force that the School stands to-day in its high and assured position.

A Lowland Scot, born in the ancient burgh of Dumfries on 20th June 1856, Anderson Stuart inherited his decisiveness, his independence of judgment, and his courage from his mother's forbears, a not infrequent line of inheritance in the lives of prominent men. In 1875, he commenced the study of medicine in Edinburgh. Huxley was then lecturing temporarily in the Chair of Natural History, and Lister had not yet migrated to London, consequently Anderson Stuart came under the influence of the teaching of both these men. After graduating, he studied physiology in Germany, and then for a year acted as assistant to Professor Rutherford in the Department of Physiology.

In 1882 the University of Sydney having made her plans for establishing a complete course in medicine, invited applications for the new Chair of Anatomy and Physiology. Anderson Stuart was appointed, and with his arrival in Australia in 1883, the real work of his life commenced; his opportunity had come to him. In his own words we are told that when taken to see what there was of the Medical School, he found the foundations of a little four-roomed cottage, with the walls built half-way up. "The workmen were lolling about chewing tobacco and spitting and thinking this the rummiest thing they had ever seen." Notwithstanding the unfinished state of "the cottage," he commenced his Professorial duties in it on the advertised date: it was typical of the enthusiasm of the man. Out of these small, uncongenial beginnings, there gradually developed the present handsome Tudor-Gothic structure, to effect the completion of which in 1889 Anderson Stuart had thrown all his energy, and over which he had exercised, since its inception, the strictest control.

In 1883, four students were enrolled in the Medical Faculty: in 1919, the number had reached 857.

In 1901 the need for an increase in hospital accommodation in Sydney was becoming urgent, and Anderson Stuart, as Chairman of the Hospital Board, threw himself into the scheme of hospital enlargement with the same zest and thoroughness which he had shown in the case of the medical buildings. On its completion, the Prince Alfred Hospital became a great modern infirmary of 500 beds with all the necessary equipment. To the end of his life he maintained an active interest in its welfare, continually developing its resources in order to increase its usefulness.

We have purposely dwelt upon his work in connection with the School and the Hospital as they constitute the two main achievements of his life, though, as his biographer shows, they by no means exhaust the field of his many activities.

The story of Anderson Stuart's career, as told by Mr Epps, should appeal to all Australians as a great record of good work done in the interests of science and of humanity.

The Practice of Medicine in the Tropics. By Many Authors. Edited by Lieut.-Colonel W. Byam, and Major R. G. Archibald. Volume II. Pp. xx + 827 + 56 (indices), with 277 illustrations. London: Henry Frowde and Hodder & Stoughton. Price £4, 4s.

The second volume of this excellent treatise fully satisfies the high expectations which were aroused by the first. It consists of four sections—on Differential Diagnosis, on Bacterial, on Spirochætal, and on Protozoal diseases.

The section on differential diagnosis from the pen of Colonel Byam is an admirable and up-to-date compendium, fully illustrated, and it should be of great service not only to practitioners abroad, but also to the many clinicians at home who, in these post-war days, come in contact with patients who have resided in tropical countries.

It is quite impossible within the space at our disposal to enter into any detailed criticism of individual articles. In every case the writers have been carefully chosen, and are representative, in their own respective spheres, of the younger school of investigators into tropical diseases. The chapters on "parasitic" diseases are extraordinarily complete, and though the bibliographies appended to the various chapters are strictly limited, the references in the text are dated, and can be readily got at. The same may be said regarding the chapters on bacillary dysentery and cerebro-spinal fever. The other chapters relating to bacterial diseases are of a more general nature, as was to be expected in a work of this type.

We may again congratulate the editors on this second evidence

of the thoroughness and care with which they have carried out their project. The volume concludes with full indices both general and of authorities referred to in the text.

Medical Ophthalmology. By R. Foster Moore, O.B.E., M.A., B.Ch. (Cantab.), F.R.C.S. Pp. viii. + 300, with 80 illustrations. London: J. & A. Churchill. 1922. Price 15s. net.

The Ophthalmology of General Practice. By Malcolm L. Hepburn. Pp. xi. + 184, with 49 illustrations. London: Cassell & Co., Ltd. 1922. Price 12s. 6d. net.

A comprehensive treatise on medical ophthalmology by a British physician or ophthalmic specialist has long been overdue. Under the more restricted title of "Medical Ophthalmoscopy" the late Sir William Gowers produced a volume which has been regarded as a classic, but the fourth and last edition appeared in 1904. More recently among the monographs contributed to the International System of Ophthalmic Practice published in the U.S.A., and edited by Dr Walker Pyle, there appeared one on Medical Ophthalmology by Dr Arnold Knapp, of New York.

The perusal of Dr Moore's work reveals that it is less systematic in its scope. For instance, eye complications in the exanthemata are scarcely mentioned, malaria is dismissed in three and a half lines. Nothing is said of the occurrence of eye troubles in or after influenza, nor is any mention made of their relation to dental disease. The author admits in his preface that the contents of his first chapter are "heterogeneous." We cannot help feeling that the epithet applies equally to a few of the succeeding chapters. The sequence of ideas which has brought some of the subjects together is somewhat difficult to follow.

But be that as it may, the volume under review deserves praise as well as criticism. A large variety of ocular manifestations of disease are surveyed and discussed in a lucid style and with considerable independence of outlook. During the past decade Dr Moore has himself made valuable contributions to our knowledge of the ophthalmoscopic appearances in arterio-sclerosis and arterio-sclerotic retinitis. A summary of his studies in this direction, as well as into the pathology of renal and diabetic retinitis and the clinical significance of various forms of retinal hæmorrhage and exudates, constitutes a large and important section of the present treatise, and for these instructive pages in particular we cordially welcome this work and recommend it to the notice of ophthalmic practitioners.

It has been Dr Hepburn's aim to produce a work that will be of value to the practitioner in dealing with ophthalmic cases, and will enable him to distinguish between cases that he can treat himself and

those that must be referred to a specialist. The task the writer has set himself is no easy one, and although his book contains a great deal of useful information, much of it is too condensed to be readily clear to readers who have not a considerable knowledge of ophthalmology. There are a number of inaccuracies and loosely written sentences that require revision. Criticism may be levelled at a number of the statements made. The assertion that there is extraordinary freedom from pain in hypopyon keratitis except during the first day or two may be instanced. No mention is made of the self-illuminating electric ophthalmoscope—the instrument *par excellence* for the relatively inexpert ophthalmoscopist. The coloured plates are a good feature of the book.

Influenza. Essays by Several Authors. Edited by F. G. Crookshank, M.D. (Lond.), F.R.C.P. Pp. 529. London: William Heineman (Medical Books), Ltd. 1922. Price 30s. net.

There has been no distinct survey of Influenza since the days of Creighton's *History of Epidemics in Britain.* The present volume gives a most comprehensive and critical review of the ramifications of a disease that has come to be looked upon as a dreaded yearly visitor. The subject has been treated by specialists, whose work has been well performed. The epidemiology, bacteriology, and clinical manifestations are all exhaustively treated. No type of the disease has been left untouched. For instance, special chapters are devoted to Nervous Syndromes, ocular, nasal, throat, and nasal complications also come in for special discussion. To the practitioner and advanced student of preventive medicine this volume should form a valuable ally.

The Place of Version in Obstetrics. By Irving W. Potter, M.D., F.A.C.S., Buffalo, N.Y. Pp. 138, with 42 illustrations. London: Henry Kimpton. 1922. Price 25s net.

In this volume Dr Potter has given a most interesting account of the history of the operation of Version from the time of Soranus up to the present day. His chapter on the "present day employment of Version" embodies a fairly full account of the position which this operation holds in the generally recognised teaching of obstetrics throughout the civilised world. As is well known to those who follow the literature of obstetrics, Dr Potter has in recent years adopted the operation to an extent which is probably unique. He claims to have performed the operation over 4000 times, and in his last 938 cases he had no maternal deaths, and a fœtal mortality which was creditably small. We are not surprised to learn that Dr Potter's advocacy of this operation, which he now adopts as

the method of delivery in about 90 per cent. of his cases, has startled his professional colleagues in America, and called down a torrent of criticism on his head. However excellent his results are in his own skilful hands, we cannot regard this introduction of an artificial element into perfectly normal labours as other than a wholly retrograde step. It may, as Dr Potter claims, diminish the risk of birth injuries by the elimination of the second stage, and it may also diminish the fear of childbirth which, from the emphasis that he places upon it, would seem to be somewhat of an obsession amongst his patients; but the widespread adoption of his technique would unquestionably lead to more disasters than could possibly be compensated by the advantages claimed. In this country there is, we think, little fear of Dr Potter's teaching being found acceptable, or regarded as other than a historical curiosity, analogous to that of Mr Figg, whose enthusiastic advocacy of version some eighty years ago in this and other Journals aroused a tempest of criticism, and in due course passed into obsolescence.

NEW EDITIONS

Forensic Medicine and Toxicology. By Dixon Mann and W. A. Brend. Sixth Edition. Pp. 573, with 25 illustrations. London: Charles Griffin & Co., Ltd. 1922. Price 30s.

Dixon Mann's *Forensic Medicine* has always been a popular book with students and practitioners, and deservedly so, because after the small Manual of Taylor ceased to be reissued, there was no text-book in the English language which gave such a good account of the subject or was so up to date in noting the advances made in Forensic Medicine and Toxicology.

Dixon Mann cut himself adrift from stereotyped descriptions and views, and wrote in a clear and concise style an original text-book which showed an extensive knowledge of foreign literature together with a sound and accurate judgment. He was an especially good chemist, and the toxicological section of the book contained the results of much original observation and is rightly regarded as a reliable authority on poisoning.

No better choice of an editor for the last two editions could have been made by the publishers than that of Dr Brend, who has carried out his share in the new edition admirably, and has maintained the high reputation of the book as one of the best, if not the best work in this country for the use of students.

New Editions

Manual of Diseases of Women. By W. E. Fothergill, M.A., B.Sc., M.D. Second Edition. Pp. xix + 433, with 149 illustrations. Edinburgh: W. Green & Son, Ltd. 1922. Price 10s. net.

In the second edition of this book some new matter has been added, including an "Appendix on Anterior Colporraphy combined with Amputation of the Cervix as a Single Operation and the Use of the Combined Operation in the Treatment of Genital Prolapse." In its general arrangement the author employs a pathological classification, the advantages of which over the old anatomical arrangement are wisely recognised. The teaching throughout is based on sound reasoning and extensive experience, and little respect is shown for methods and practices which have nothing to support them but tradition. The book can be cordially recommended to the student, for whom it is primarily intended. There is room for improvement in the illustrations, especially in regard to those representing microscopic appearances. In many the photography is bad.

Neoplastic Diseases: A Treatise on Tumours. By James Ewing. Second Edition. Pp. 1054, with 514 illustrations. Philadelphia: W. B. Saunders Company. 1922. Price 55s. net.

That three years after the publication of the first edition a second should have been called for, is evidence in itself of the value of this book, and of its wide acceptance as a trustworthy exposition of its subject. The second edition is increased by twenty-seven pages and has thirty-five more illustrations than the first. We consider it the fullest and most authoritative book on oncology, as desirable for guidance as for reference.

The arrangement of the book remains as in the previous edition. A short historical chapter is followed by eight chapters on general oncology, which are most interesting and valuable and quite up-to-date. The several chapters on what relates to malignant growths are well worth perusal by the general practitioner, the laboratory worker, and the pathologist alike. They contain a fair résumé of the enormous amount of work done on the subject in this country as well as in America and elsewhere.

The special oncology is the best exposition of individual tumours we know, and the observations as to the gross anatomy and the clinical symptoms and course form a practical feature which meets with approval. Too large as a text-book for the ordinary medical course of study, it is indispensable for the instruction of senior students and for the oncologist. A few of the macroscopic photographs, *e.g.*, "Fig. 422—Leukoplakia of tongue," are, we venture to think, not up to the standard of general excellence; but perhaps a good deal

has been lost in the reproduction of the photographs. We consider that it would be advantageous to have the degree of magnification indicated on the print of each microscopic section.

The type is clear and distinct and the illustrations on the whole are very good. There is a useful bibliography and a good index.

Text-Book of Practical Therapeutics. Hobart Amory Hare, M.D., LL.D., B.Sc. Eighteenth Edition. Pp. 1038, with 150 illustrations. London: Henry Kimpton. 1922. Price 36s net.

Probably there is no book so useful to the consultant and general practitioner as a good well-arranged and well-condensed work on Therapeutics. There are many types of physician, but two types are well known—the one who sticks closely to what he has found to be from his experience the reliable drugs and prescriptions, rarely testing anything new; the other constantly prescribing the latest form of medicaments which have been brought by the post to his attention at his breakfast-table.

The careful study of a book such as this cannot fail to render the first type more fertile on expedients, and the second more scientifically successful in his treatment. The new edition of this American work has been brought thoroughly up-to-date. It is divided into two parts, the first treating of drugs, medicaments, and other forms and methods of treatment, the second dealing with the diseases and their treatment. The former is practically a work on Materia Medica, etc., the second is a condensed work on what is usually included under the "treatment" paragraphs of a work on systematic medicine. Both parts have their subject-matter arranged alphabetically, so that what is looked for can be referred to at once. The work is equally useful to American and British readers, as both the American and British preparations with their doses are given; the apothecary's weights and measures have also the metric system equivalents bracketed alongside them.

Whilst having nothing but praise for the book as a whole, except the grating feeling that some of the modern American spelling produces on a British reader, we would especially commend the useful well-written account of some of the more recent remedial measures other than drugs, such as lumbar puncture, cold bathing, intravenous injections, feeding the sick, etc. It is a great advantage to have a work like this in one volume, otherwise we would be inclined to say that, on account of its size and the weight of the paper, a division into two would add to the comfort of the reader.

NOTES ON BOOKS

Hormone Therapy by Sera, Vaccines, and Drugs (Baillière, Tindall & Cox, 1922, price 7s. 6d. net). Dr Montgomerie Paton discusses some unique methods of treatment of which he has had twenty-three years' experience. He states that even if his explanations are not correct there is at least no doubt about the excellent results obtained. "The therapeutic effects so far discovered read more like an Arabian Night's dream than a statement of sober facts" (p. 74). The author claims great benefit from the oral administration of large quantities of normal serum (hormonax) or weak antidiphtheritic serum, and explains that their action is entirely due to the hormones present in them. He also believes that he can influence the production of hormones by the patient himself, and for this purpose he recommends hypodermic injections of emetine, of cantharides, or of a stock streptococcal vaccine in different cases. The book abounds in unsupported statements which detract from its value as a sober review of facts, *e.g.*, "the hormones contain the vitamines" (p. 131). The author has failed to convince us of the soundness of his reasoning, but in these days of treatment by nonspecific protein our judgment must be suspended.

Mrs Rumley Dawson has produced this third edition of her late husband's work, *The Causation of Sex in Man* (H. K. Lewis & Co., Ltd.), explanatory of his views on the causation of sex. The fact that Dr Rumley Dawson is no longer with us makes it invidious to criticise this volume, while for the devotion which his widow has shown in publishing this edition there can be nothing but admiration. At the same time it is only right to say that in our opinion the late Dr Rumley Dawson's theory was based on a series of assumptions which are not capable of proof, and that, on the other hand, his conclusions have been disproved again and again. The book is the outcome of a great deal of painstaking diligence, and it is all the more to be regretted that the argument cannot be regarded as on a really scientific level.

The Principles of Immunology, by Howard J. Karsner, M.D., and Enrique E. Ecker, Ph.D., Western Reserve University, Cleveland (J. B. Lippincott Company, price 21s. net). Setting out with the aim of giving a concise statement of the fundamental principles of immunology, the authors are to be congratulated on their success. The omission of a reference list of the literature mentioned is to be regretted, for undoubtedly the book will create a desire in its readers to study original papers on the subjects dealt with. Many recent researches are referred to. The experience gained in the war on the use of anti-toxic sera for tetanus, gas gangrene, and dysentery is recorded. Attention is paid to the isohæmagglutinins and their importance in relation to blood trans-

fusion. Jansky's original classification of bloods is adhered to as the working guide, and methods for testing human blood with and without standard sera are given in detail. Dreyer's macroscopic method for agglutination tests is included. The practical application of the precipitin test in the detection of food adulteration and the identification of human protein is dealt with. A useful chapter on "Complement Fixation" precedes a full description of the Wassermann test. A chapter is devoted to Hypersusceptibility and the tests pertaining thereto.

In three appendices an account is given of the therapeutic use of blood serum (anti-bacterial, auto serum, human immune serum, normal serum, etc.) and the prophylactic and therapeutic use of vaccines, with general indications as to the results obtained. Detoxicated vaccines receive only scant notice.

The Blood Supply to the Heart, by Louis Gross (Paul B. Hoeber, 1921, price $5), incorporates investigations made by the author in Montreal, and affords a very complete description of the arterial and venous blood supply to the myocardium, to the nodes and bundle, and to the cardiac valves. In the fœtal heart the valves contain muscle fibres and blood-vessels, but both undergo regression as age advances, and in relatively few normal adult hearts do the valves show a distinct vasculature. The anterior cusp of the mitral valve is the last to lose its vessels. The author considers that persistence of valvular blood-vessels increases the liability to endocarditis. The anastomoses between the coronary arteries and their branches are depicted. In the young adult these anastomoses are usually insufficient to prevent infarction; whereas in relatively old persons, the anastomoses being more patent and free, infarction is less frequent. All the illustrations are excellent.

It is doubtful with which edition a medical text-book passes beyond the range of criticism and calls only for comment. Certain it is, however, that *Taylor's Practice of Medicine* (J. & A. Churchill, price 30s. net) has long since reached this distinction. It is over thirty years since it first appeared, and in this, its twelfth edition, edited by Dr E. P. Poulton, it maintains its position as the best text-book of its class in the English language.

A Manual of Practical Anatomy, Part II., by Thomas Walmsley (Longmans, Green, & Co., 1921, price 10s. 6d. net). The second volume of this series is constructed on the same plan as its predecessor, namely, with a view to providing the student with a directory of dissection supplemented with short and concise descriptions. The present volume deals with the dissection of the thorax and abdomen, and the author's method of treatment has here been highly successful.

He has omitted the burden of detail with which so many dissecting manuals are encumbered, especially in regard to relations of such structures as the great vessels of the thorax and certain of the abdominal viscera, without detriment to clearness of description. The illustrations also fully attain their purpose, being simple and clear and yet complete as regards the essential facts

The Principles of Radiography, by J. A. Crowther, M.A., Sc.D. (J. & A. Churchill, 7s. 6d.) is eminently suited to those commencing the study of radiology, and wishing a working knowledge of the subject.

Students of medical history will find in Dr J. D. Comrie's *Selected Works of Thomas Sydenham* (Bale, Sons, & Danielsson, 1922, price 8s. 6d.) a discriminative selection of purple patches from the works of "the prince of English physicians," with illuminating explanatory notes and a short biography.

Sir Charles Ballance has published his Thomas Vicary Lecture on the *History of the Surgery of the Brain* (Macmillan). It is an interesting sketch, running to 110 pages, and costs 10s. 6d.

When Dr F. M. Pottenger's *Symptoms of Visceral Disease* (Henry Kimpton, price 28s. net) first appeared about two years ago, we welcomed it as a valuable exposition of the relationship of the vegetative nervous system and the endocrine glands to various problems in clinical medicine and surgery. Since then much attention has been directed to this subject, largely through the influence of Sir James Mackenzie in this country and of Dr Pottenger in America. The early call for a second edition indicates that we were not alone in our appreciation of Dr Pottenger's work, which we again strongly commend to our readers. It is a fascinating presentation of an outlook on clinical medicine which seeks to interpret the symptoms of disease in terms of disturbed physiology.

In the first and second volumes of *International Clinics* (thirty-second series, J. B. Lippincott Company) appear a number of articles chiefly American in origin. Dr Cumston's paper on "Pathologic Processes of the Testicle" is of special interest. Considerable space is devoted to surgery, but the various branches of medicine are also dealt with, though the articles are by no means of equal value. As is usual in these volumes the illustrations are good.

In the first American edition of *Abdominal Pain* (Rebman Company, price $5.00) Dr Brams and Dr Luger have given an excellent translation of the second edition of Professor Ortner's work. The early part of the book deals with diffuse abdominal pain, but so many conditions are differentiated, and the subject matter is so condensed in places

that the reader is apt to get somewhat bewildered. The sections on localised abdominal pain are, however, much more readable. In an appendix, abdominal pain is discussed from the point of view of its character rather than its location. The volume is based upon the author's teaching in Vienna and is full of information of the greatest clinical value.

Dr Henry Letheby Tidy's *Synopsis of Medicine* (John Wright & Sons, Ltd., price 21s. net) is written mainly in list form, with short explanatory notes. Its popularity is evident from the early appearance of a second edition.

NOTES

Royal College of Surgeons of Edinburgh.

At the Meeting of the Royal College of Surgeons of Edinburgh, held on 18th October, Sir David Wallace, C.M.G., was re-elected President for the ensuing year; Dr George Mackay, Vice-President; and Mr Alexander Miles, F.R.C.S.E., Secretary and Treasurer.

The following nineteen successful candidates out of sixty-two entered, who passed the requisite examinations between 3rd and 10th July 1922, were admitted Fellows:—Peter M. Brodie, M.B., Ch.B. Edin.; William A. Brown, M.B. Ch.B. Edin.; Donald Buchanan, M.B., Ch.B., M.D. Aberd., D.P.H. Birm.; Joseph T. Carson, M.B., Ch.B. Edin.; John S. M. Connell, L.R.C.S.E. (Triple); Josias Daneel, M.B., Ch.B. Edin.; Eion L. Ferguson, M.B., Ch.B. Edin.; Henry L. H. Greer, M.B., B.S. Lond., D.P.H., R.C.P. & S.I.; Charles R. R. Huxtable, M.B. Sydney; Marjorie M. Jefferson, M.R.C.S. Eng., L.R.C.P. Lond., M.B., B.S. Lond.; Ivan B. Jose, M.B., B.S. Adelaide; Leonard C. E. Lindon, M.B., B.S. Adelaide; George A. Petrie, M.D., C.M. Manitoba, M.C.P. & S. Manitoba, M.R.C.S. Eng., L.R.C.P. Lond.; Edwin D. Pullon, M.B., Ch.B., M.D. Edin.; Bertie S. Simpson, M.B., Ch.B. Edin.; Hari V. Tilak, M.B., B.S. Bombay; Vernon N. Whitamore, M.R.C.S. Eng., L.R.C.P. Lond.; James L. Will, M.B., Ch.B. New Zealand; Ethel D. Willis, M.B., Ch.B. Manc.

Dr Kandappah Rajah, L.M. & S. Ceylon, 1908, was admitted a Licentiate of the Royal College of Surgeons of Edinburgh.

The following were granted the Diploma L.D.S., R.C.S. Edin.:—Angus Millar, Oswald F. Lowe, Frederick W. S. Finch, David Mason, James Stewart, Gordon S. Richardson, Rosamond Caseley, William M. Fisher, Alexander J. Sutherland, Margaret H. White, Alexander G. Cresswell, David Geekie, John N. Rodger, and John Young.

Notes

Triple Qualification Passes.

THE following candidates having passed the Final Examination have been admitted, L.R.C.P.E., L.R.C.S.E., L.R.C.P. & S.G.:—John E. Overstead, Adriaan V. Bergh, A. A. Dewar, Samuel I. T. Wills, Marjory J. A. Ogilvie, James A. M. S. Evers, Pincus Schneiderman, Lilian M. Williams, Peter B. Fernando, Wilson O. Rodrigo, Leslie I. Myerson, Solomon J. Rom, James M. M'Innes, Cecil J. Cellan-Jones, William L. Murray, Isabel Falconer King, Thomas T. Hoskins, Ferdinand H. A. Stegmann, Sathasivam Ponniah, and Peter J. B. Dyce.

Diploma in Public Health.

THE following candidates having passed the requisite examinations, were admitted Diplomates in Public Health:—Douglas J. A. Kerr, M.B., Ch.B.; Jane W. Macdonald, M.B., Ch.B.; Gertrude D. M'Laren, M.B., Ch.B.; Andrew Climie, M.B., Ch.B.; Jean M. Mackintosh, M.B., Ch.B.; Mary Steven, M.B., Ch.B.; Agnes H. M. Young, M.B., Ch.B.; Ralph C. L. Batchelor, M.B., Ch.B., F.R.C.S.E; Annie M. Alexander, M.B., Ch.B.; John A. Fraser, M.B., Ch.B.; Alexander Joe, M.B., Ch.B.; James H. Clarke, M.B., Ch.B.; Douglas R. Cramb, M.B., Ch.B.; Richard J. O. Taylor, M.B., Ch.B.; Mary L. Wilson, M.B., Ch.B.; Christian M. Fleming, M.B., Ch.B.; Joseph M'Culloch, M.B., Ch.B.; Eileen R. Freeman, M.B., Ch.B.; Marion C. Taylor, M.B., Ch.B.; John M'Garrity, M.B., Ch.B.

University of Edinburgh.

THE following have obtained the degrees of M.B., Ch.B.:—James W. Anderson; Frank Booth.

The *Diploma in Public Health* was granted to Miss Jean Murray, M.B., Ch.B.

XIth International Physiological Congress.

THE XIth International Physiological Congress will be held in Edinburgh from 23rd July to 27th July, 1923. *President*—Professor Sir Edward Sharpey Schafer, M.D., F.R.S. *Treasurer*—Professor Arthur R. Cushny, M.D., F.R.S. *Secretaries*—Professors George Barger, D.Sc., F.R.S.; Jonathan C. Meakins, M.D. *Assistant Secretaries*—Miss Dorothy Charlton.

Those who desire to be enrolled as members are requested to forward their names and addresses, together with the amount of their subscription (25 shillings), to Miss Charlton, Department of Physiology, University, Edinburgh, who will send on request particulars of hotels and lodgings, and all other necessary information.

Books Received

Dalhousie University, Halifax, Nova Scotia.

MANY of our Edinburgh and other Graduates will be interested to learn that the Corner-Stone of the Medical Science Laboratory Building of Dalhousie College was laid in September by the well-known evergreen veteran Surgeon, Colonel John Stewart. It bears the following inscription:—

This Stone was laid by
JOHN STEWART, M.B., C.M., LL.D., C.B.E.,
Dean of Faculty of Medicine.
1922.

At the ceremony the same trowel was used with which Lord Dalhousie laid the Corner-Stone of the first Dalhousie Buildings over one hundred years ago.

BOOKS RECEIVED

BEESLY, LEWIS, and T. B. JOHNSTON. Manual of Surgical Anatomy. Second Edition . . . . . (*Oxford Medical Publications*) 16s.
BIBLIOGRAPHY OF HOOKWORM DISEASE (*The Rockefeller Foundation*)
BLOMFIELD, J. Anæsthetics in Practice and Theory (*Wm. Heinemann* (*Medical Books*), *Ltd.*) 25s.
COLEMAN, FRANK. Materia Medica for Dentists. Fifth Edition *Oxford Medical Publications* 10s. 6d.
CROWTHER, J. A. Practical Physics (*Oxford Medical Publications*) 10s. 6d.
CUNNINGHAM'S TEXT-BOOK OF ANATOMY. Edited by Arthur Robinson. Fifth Edition . . . . . (*Oxford Medical Publications*) 42s.
CURZON-MILLER, A. G. Physiology for Dental Students (*Edward Arnold & Co.*) 10s. 6d.
HEWITT, FREDERICK W. Edited by Henry Robinson. Anæsthetics and their Administration. Fifth Edition (*Oxford Medical Publications*) 30s.
HEWLETT, R. TANNER. Pathology, General and Special. Fifth Edition (*J. & A. Churchill*) 18s.
M'KAY, W. J. STEWART. Lawson Tait: His Life and Work (*Bailliere, Tindall, & Cox*) 25s.
MACLEAN, HUGH. Modern Methods in the Diagnosis and Treatment of Glycosuria and Diabetes . . . . . (*Constable & Co., Ltd.*) 12s.
MITCHELL, J. M., I. N. ASHESHOV, and G. P. N. RICHARDSON. Typhus Fever . . . . . (*Bailliere, Tindall, & Cox*) 3s. 6d.
MYERS, BERNARD. Practical Handbook on the Diseases of Children (*H. K. Lewis & Co., Ltd.*) 21s.
NESFIELD, V. Ophthalmic Surgery. . (*H. K. Lewis & Co., Ltd.*) 9s.
PEAR, T. H. Remembering and Forgetting (*Methuen & Co., Ltd.*) 7s. 6d.
ROCKEFELLER FOUNDATION. Annual Report. 1921
ROMANIS, W. H. C. Surgical Diagnosis . . . (*J. & A. Churchill*) 8s. 6d.
SHORT, A. RENDLE, Edited by. An Index of Prognosis and End-Results of Treatment. Third Edition . . (*John Wright & Sons, Ltd.*) 42s.
STITT, E. R. The Diagnostics and Treatment of Tropical Diseases. Fourth Edition . . . . . (*H. K. Lewis & Co., Ltd.*) 18s.
WILSON, WILLIAM. A Handbook of Aural Surgery (*Sherratt & Hughes*) 15s.

INDEX

NOTE.—Entries with *Chir.* and *Obst.* refer to Medico-Chirurgical and Obstetrical Societies' Transactions respectively.

ABORTION, Secondary Abdominal Pregnancy following Incomplete Tubal, Dem. by E. F. Murray, *Obst.*, 108
Achalasia, Œsophageal (D. M. Greig), 217
Affleck, Sir James O., *see* Obituaries, 253
Anæmia, Primary, *Chir.*, 135
Anæsthesia, Spinal, Observations on (D. N. Kalyanvala), 25, 74
Anæsthetists, Scottish Society of, 258
Anatomical Instruction at Edinburgh, Early (J. D. Comrie), 273
Aortitis, with Special Reference to Syphilitic Aortitis (S. B. B. Campbell), 109
Appointments, 46, 96
Artery, Case of Ligature of Popliteal, for repeated Secondary Hæmorrhages, *Chir.*, 139
—— Case of Ruptured Axillary, and Gangrene of Forearm, *Chir.*, 137
Auricular Fibrillation, Observations on the Action of Quinidine Sulphate on Three Cases of (Walwyn and Fowler), 65
—— The Therapeutic Value of Quinidine Sulphate in (W. T. Ritchie), *Chir.*, 105

BAGHDAD, Variola in (H. C. Sinderson), 18
(Bilharziasis), Endemic Hæmaturia, *Chir.*, 135
Blood, Histological Demonstration of, *Chir.*, 134
Books Received, 48, 96, 160, 271, 326
Bronchiectasis, *Chir.*, 136
Brown, Alexander Crum, *see* Obituaries, 310
Brown, Cecil C., The Urethrescope as an Aid to the Diagnosis and Treatment of Gonorrhœa, 49, 136
Brown, J. J. Graham, Note on Sthenic Dyspepsia—"Hyperchlorhydria," 161
Brown, K. Paterson, A Case of Congenital Narrowing of the Œsophagus, *Cl. Rec.*, 145
—— A Case of Solitary Cyst in the Humerus (*Osteitis Fibrosa Cystica*), *Cl. Rec.*, 306

CALMETTE, A., The Protection of Mankind against Tuberculosis, *Chir.*, 93
Campbell, S. B. Boyd, Aortitis, with Special Reference to Syphilitic Aortitis, 109
Cancerous Growths, Further Study of an Organism obtained from (J. Young), *Obst.*, 110
Children, Some Factors Modifying the Nutrition of (Madge B. Gribbon), 12
Chorion Epithelioma of the Uterus, Dem. by R. G. M'Kerron, *Obst.*, 103
Clinical Meeting, Special, *Chir.*, 134
Clinical Records—
  Chronic Interstitial Nephritis in Childhood: Renal Infantilism (H. L. Watson-Wemyss), 300
  Congenital Narrowing of the Œsophagus (K. Paterson Brown), 145
  Lateral Dislocation in the Lumbar Spine (J. N. J. Hartley), 34

Clinical Records—*continued*
Myositis Ossificans Progressiva in a Child (J. A. Henderson), 148
Passage of Latchkey through the Intestinal Canal (H. A. Lediard), 213
Solitary Cyst in the Humerus (K. Paterson Brown), 306
Cochrane, Wm. A., The Treatment of Disabilities of the Hand and Wrist: An Anatomical Review in Relation to Function, 97
Comrie, John D., Early Anatomical Instruction at Edinburgh, 273
Critical Review—
Pathological and Clinical Aspects of Deaf-Mutes (J. S. Fraser), 247
Curriculum, The Medical, i-xxxii
Cyst, Mesenteric Case of, *Chir.*, 138
—— Solitary, In the Humerus, Case of (K. Paterson Brown), *Cl. Rec.*, 306
—— Traumatic Pancreatic, Case of, *Chir.*, 139

DALHOUSIE University, 326
Dautrebande, Lucien, and H. Whitridge Davies, Variations in Respiratory Exchange with Masks of Different Types, 127
Davidson, H. S., and Douglas Miller, Record of Eclampsia in the Royal Maternity Hospital, Edinburgh, during Ten Years, 1912-1922, *Obst.*, 121
Davies, H. Whitridge, Methods for the Therapeutic Administration of Oxygen, *Chir.*, 161
—— *see* Dautrebande, 127
Deaf-Mutes, The Pathological and Clinical Aspects of (J. S. Fraser), *Cr. Rev.*, 247
Dislocation, Lateral, in the Lumbar Spine (J. N. J. Hartley), *Cl. Rec.*, 34
Duodenal Ulcer, Case of, *Chir.*, 140
—— Complicating Chronic Duodenal Ileus, Two Cases of, *Chir.*, 140
Dyspepsia, Sthenic — "Hyperchlorhydria," Note on (J. J. Graham Brown), 161

ECLAMPSIA, Record of (H. S. Davidson and D. Miller), *Obst.*, 121
Epithelioma, Chorion, of the Uterus, Dem. by R. G. M'Kerron, *Obst.*, 103
Eyelid, Repair of the Upper, Case of, *Chir.*, 141

FIBRILLATION, Auricular, Observations on the Action of Quinidine Sulphate on Three Cases of (Walwyn and Fowler), 65
—— The Therapeutic Value of Quinidine Sulphate in (W. T. Ritchie), *Chir.*, 105
Foggie, W. E., Congenital Hyperkeratosis, 229
Fowler, J. S., On the Significance of Pyuria in Children, 1
—— *see* Walwyn, W. M'L., 65
Fraser, J. S., The Pathological and Clinical Aspects of Deaf-Mutes, *Cr. Rev.*, 247

GANGRENE of Forearm, Case of Ruptured Axillary Artery and, *Chir.*, 137
Gonorrhœa, The Urethrescope as an Aid in the Diagnosis and Treatment of (C. C. Brown), 49, 136
Graduation, Summer, 158
Greig, David M., An Old-time Reminiscence of Trench Foot, 297
—— Œsophageal Achalasia, 217
Gribbon, Madge B., Some Factors Modifying the Nutrition of Children, 12
Guthrie, Douglas, The Plastic Surgery of the Nose, *Chir.*, 115

HÆMATURIA, Endemic (Bilharziasis), *Chir.*, 135
Hand and Wrist: The Treatment of Disabilities of the (W. A. Cochrane), 97
Hartley, J. N. J., Lateral Dislocation in the Lumbar Spine, *Cl. Rec.*, 34
Henderson, John A., A Case of Myositis Ossificans Progressiva in a Child, *Cl. Rec.*, 148

Index

Humerus, Case of Solitary Cyst in the (K. Paterson Brown), *Cl. Rec.*, 306
Hyperchlorhydria — Sthenic Dyspepsia, Note on (J. J. Graham Brown), 161
Hyperkeratosis, Congenital (W. E. Foggie), 229

Icterus Neonatorum (E. F. Murray), *Obst.*, 86
Ileus, Chronic Duodenal, Two Cases of Duodenal Ulcer Complicating, *Chir.*, 140
Intestinal Canal, Passage of Latchkey through (H. A. Lediard), *Cl. Rec.*, 213

Johnstone, R. W., Uterus Didelphys, *Obst.*, 85

Kalyanvala, D. N., Observations on Spinal Anæsthesia, 25. 74

Latchkey, Passage of, through the Intestinal Canal (H. A. Lediard), *Cl. Rec.*, 213
Lediard, H. A., Passage of Latchkey through the Intestinal Canal, *Cl. Rec.*, 213
Lees, David, An Alternative Method of Administering Vaccines, *Chir.*, 117
Lumbar Spine, Lateral Dislocation in (J. N. J. Hartley), *Cl. Rec.*, 34

Macpherson, Sir John, 46
Masks of Different Types, Variations in Respiratory Exchange with (Dautrebande and Davies), 127
Meakins, Jonathan, Oxygen-Want: Its Causes, Signs, and Treatment, *Chir.*, 142, 153
Mesenteric Cyst, Case of, *Chir.*, 138
Miller, Douglas, Omphalorrhagia, with a Record of Two Cases, *Obst.*, 97
—— *see* H. S. Davidson, *Obst.*, 121
Murray, E. Farquhar, Icterus Neonatorum, *Obst.*, 86
—— Dem. of Secondary Abdominal Pregnancy following Incomplete Tubal Abortion, *Obst.*, 108
Myositis Ossificans Progressiva in a Child (J. A. Henderson), *Cl. Rec.*, 148

Narrowing of the Œsophagus, A Case of Congenital (K. Paterson Brown), *Cl. Rec.*, 145
Nephritis, Chronic Interstitial, in Childhood: Renal Infantilism (H. L. Watson-Wemyss), *Cl. Rec.*, 300
Nose, The Plastic Surgery of the (D. Guthrie), *Chir.*, 115
Nutrition of Children, Some Factors Modifying the (Madge B. Gribbon), 12

Obituaries—
Alexander Crum Brown, 310
Sir James O. Affleck, 253
Œsophageal Achalasia (D. M. Greig), 217
Œsophagus, A Case of Congenital Narrowing of the (K. Paterson Brown), *Cl. Rec.*, 145
Omphalorrhagia, with a Record of Two Cases (D. Miller), *Obst.*, 97
Ovariotomy, The Father of, 238
Oxycephaly, *Chir.*, 136
Oxygen-Want: Its Causes, Signs, and Treatment (J. Meakins), *Chir.*, 142, 153
Oxygen, Methods for the Therapeutic Administration of (H. W. Davies), *Chir.*, 161

Pancreatic Cyst, Traumatic, Case of, *Chir.*, 139
Passes, 47, 159, 324
Physiological Congress, 325
Plastic Surgery of the Nose (D. Guthrie), *Chir.*, 115
Popliteal Artery, Case of Ligature of, for repeated Secondary Hæmorhages, *Chir.*, 139
Pregnancy, Secondary Abdominal, following Incomplete Tubal Abortion (Dem. by F. Murray), *Obst.*, 108
Pyuria in Children, On the Significance of (J. S. Fowler), 1

Index

QUINIDINE Sulphate in Auricular Fibrillation, The Therapeutic Value of (W. T. Ritchie), *Chir.*, 105

—— on Three Cases of Auricular Fibrillation, Observations on the Action of (Walwyn and Fowler), 65

RENAL Disease, The Choice of Methods employed in the Surgical Diagnosis of (H. Wade), *Chir.*, 169

Renal Infantilism (?) Chronic Interstitial Nephritis in Childhood: (H. L. Watson-Wemyss), *Cl. Rec.*, 300

Respiration, Disturbances of, *Chir.*, 134

Respiratory Exchange, Variations in, with Masks of Different Types (Dautrebande and Davies), 127

REVIEWS—

Archives of Medical Hydrology, 270

Archives of Occupational Therapy, 271

Bainbridge, William Seaman, *Le Problême du Cancer*, 154

Ballance, Sir Charles, *History of the Surgery of the Brain*, 323

Bandler, S. W., *The Endocrines*, 155

Bardswell, Noel, *The Tuberculosis Clinic*, 270

Bland-Sutton, Sir J., *Tumours: Innocent and Malignant*, 95

Brend, W. A., *Handbook of Medical Jurisprudence and Toxicology*, 268

Brill, A. A., *Psycho-Analysis*, 267

Bulkley, K. Duncan, *Cancer and its Non-Surgical Treatment*, 154

Butler, Glentworth Reeve, *The Diagnostics of Internal Medicine*, 265

Buzzard, E. Farquhar, and J. Godwin Greenfield, *Pathology of the Nervous System*, 152

Byam, W., and R. G. Archibald, Edited by, *The Practice of Medicine in the Tropics*, vol. ii., 315

Campbell, William F., *Surgical Anatomy*, 215

Clarkson, Ernest R. T., *The Venereal Clinic*, 215

Reviews—*continued*

Cobb, Ivo Geikie, *The Organs of Internal Secretion*, 45

Colwell, Hector A., *An Essay on the History of Electrotherapy and Diagnosis*, 216

Comrie, J. D., *Selected Works of Thomas Sydenham*, 323

Craig, Maurice, *Nerve Exhaustion*, 43

Crookshank, F. G., Edited by, *Influenza*, 317

Crowther, J. A., *The Principles of Radiography*, 323

Cumston, C. G., Translated by, Labbé's *Diabète Sucré*, 269

Dawson, E. Rumley, *The Causation of Sex in Man*, 321

Dick, J. Lawson, *Rickets*, 156

Dixon, H. H., *Practical Plant Biology*, 269

Epps, William, *Life of Sir T. P. Anderson Stuart, M.D.*, 314

Ewing, James, *Neoplastic Diseases: A Treatise on Tumours*, 319

Faught, F. A., *The Essentials of Laboratory Diagnosis*, 157

Fiolle, J., and J. Delmas, *The Surgical Exposure of the Deep-seated Blood Vessels*, 215

Fischer, Martin H., *Œdema and Nephritis*, 264

Fothergill, W. E., *Manual of Diseases of Women*, 319

—— *Manual of Midwifery*, 268

Françon, Dr, Translated by, Mackenzie's *Future of Medicine*, 269

Giltner, Ward, *Laboratory Manual in General Microbiology*, 270

Gould, Eric Pearce, *Surgical Pathology*, 270

Gross, Louis, *The Blood Supply to the Heart*, 322

Handley, W. Sampson, *Cancer of the Breast and its Treatment*, 157

Hare, Hobart Amory, *Text-Book of Practical Therapeutics*, 320

Hawk, Philip B., *Practical Physiological Chemistry*, 158

Index

Reviews—*continued*

Hayes, Reginald, *The Intensive Treatment of Syphilis and Locomotor Ataxia by Aachen Methods*, 215

Hepburn, Malcolm L., *The Ophthalmology of General Practice*, 316

Index of Treatment, by Various Writers, 94

International Clinics, vols. i. and ii., 323

Jellett, Henry, *Midwifery for Nurses*, 216

Journal of Metabolic Research, 270

Karsner, H. J., and E. E. Ecker, *The Principles of Immunology*, 321

Ker, C. B., *Manual of Fevers*, 93

Keynes, Geoffrey, *Blood Transfusion*, 156

Kramer, John B., *Radiations from Slow Radium*, 216

Little, E. Muirhead, *Artificial Limbs and Amputation Stumps*, 262

Luke, Thomas Davey, *Manual of Psycho-Therapeutics*, 268

M'Cann, Frederick John, *The Treatment of Common Female Ailments*, 268

Macewen, John A. C., *Text-Book of Surgery*, 267

M'Grath, John J., *Operative Surgery*, 95

Macpherson, Sir W. G., *History of the Great War*, 90

Magian, A. C., *The Practitioner's Manual of Gynæcology*, 216

Mann, J. Dixon, and W. A. Brend, *Forensic Medicine and Toxicology*, 318

Mayo Clinic, Collected Papers of, 95

Mayo Foundation, Papers from the, 46

Medical Annual, 1922, 270

Moore, R. Foster, *Medical Ophthalmology*, 316

Muthu, David C., *Pulmonary Tuberculosis*, 44

Ontario Journal of Neuro-psychiatry, 271

Reviews—*continued*

Opie, Eugene L., and others, *Epidemic Repiratory Disease*, 153

Ortner, Norbert, *Abdominal Pain*, 323

Paton, D. Montgomerie, *Hormone Therapy by Sera, Vaccines, and Drugs*, 321

Porter, Langley, and William E. Carter, *Management of the Sick Infant*, 155

Post-Graduate Lectures, 269

Pottenger, F. M., *Symptoms of Visceral Disease*, 323

Potter, Irving W., *The Place of Version in Obstetrics*, 317

Poulton, E. P., Edited by, *Taylor's Practice of Medicine*, 322

Putnam, J. J., *Addresses on Psycho-Analysis*, 44

Quervain, F. de, *Clinical Surgical Diagnosis*, 42

Robertson, W. Ford, *Therapeutic Immunisation*, 39

Schafer, Sir E. Sharpey, *Experimental Physiology*, 215

Shaw, H. Batty, *Hyperpiesia and Hyperpiesis (Hypertention)*, 266

Shuttleworth, G. E., and W. A. Potts, *Mentally Deficient Children*, 94

Sidis, Boris, *Symptomatology, Psychognosis, and Diagnosis of Psychopathic Diseases*, 92

Smith, A. Lapthorn, *How to be Happy and Useful from Sixty to Ninety*, 91

Somerville, H., *Practical Psycho-Analysis*, 267

Souttar, Henry S., *Injuries of the Peripheral Nerves*, 152

Stiles, Sir Harold J., and M. F. Forrester-Brown, *Treatment of Injuries of the Peripheral Spinal Nerves*, 90

Sutton, Richard L., *Diseases of the Skin*, 43

Tidy, Henry Letheby, *Synopsis of Medicine*, 324

Transactions of the American Gynecological Society, 1920, 45

Index

Reviews—*continued*
Transactions of the American Surgical Association, 1920, 45
Transactions of the College of Physicians of Philadelphia, 1920, 46
Turrell, W. J., *The Principles of Electrotherapy and their Practical Application*, 216
Underhill, Frank P., *Selected Biochemical Methods as Applied to Urine, Blood, and Gastric Analysis*, 270
Vaughan, Victor C., and Henry F., *Epidemiology and Public Health*, 91
Walmsley, Thomas, *A Manual of Practical Anatomy*, Part II., 322
Webster, Alfred, *Cardiac Arrhythmia and the Neocardiology*, 269
Webster, L. T., *Lymphosarcoma, Lymphatic Leukæmia, Leucosarcoma, Hodgkin's Disease*, 95
Wolbach, S. Burt, *The Etiology and Pathology of Typhus*, 266
Ritchie, W. T., The Therapeutic Value of Quinidine Sulphate in Auricular Fibrillation, *Chir.*, 105
Royal College of Physicians, 46
Royal College of Surgeons, 47, 159, 324

SCOTTISH Society of Anæsthetists, 258
Sinderson, H. C., Variola in Baghdad, 18
Spinal Anæsthesia, Observations on (D. N. Kalyanvala), 25, 74
Spine, Lateral Dislocation in the Lumbar (J. N. J. Hartley), *Clin. Rec.*, 34
Spleen, Enlargement of the, *Chir.*, 134
Sthenic Dyspepsia — Hyperchlorhydria, Note on (J. J. Graham Brown), 161
Syphilitic Aortitis, Aortitis with Special Reference to (S. B. B. Campbell), 109

THOMSON'S Apparatus, *Chir.*, 134
Trench Foot, An Old-Time Reminiscence of (D. M. Greig), 297
Tubal Abortion, Incomplete, Secondary Abdominal Pregnancy following (Dem. by E. F. Murray), *Obst.*, 108
Tuberculin by Innunction, *Chir.*, 135
Tuberculosis, The Protection of Mankind against (A. Calmette), *Chir.*, 93
—— Two Cases illustrating Value of Tuberculin, *Chir.*, 135

ULCER, Duodenal, Case of, *Chir.*, 140
—— Two Cases of, complicating Chronic Duodenal Ileus, *Chir.*, 140
Urethrescope as an Aid to the Diagnosis and Treatment of Gonorrhœa (C. C. Brown), 49, 136
Uterus, Chorion Epithelioma of the (Dem. by R. G. M'Kerron), *Obst.* 103
—— Didelphys (R. W. Johnstone), *Obst.*, 85

VACCINES, An Alternative Method of Administering (David Lees), *Chir.*, 117
Variola in Baghdad (H. C. Sinderson), 18
Vienna Letters, 88, 245, 312

WADE, Henry, The Choice of Methods employed in the Surgical Diagnosis of Renal Disease, *Chir.*, 169
Walwyn, W. M'L., and J. S. Fowler, Observations on the Action of Quinidine Sulphate on Three Cases of Auricular Fibrillation, 65
Watson-Wemyss, H. L., Chronic Interstitial Nephritis in Childhood: Renal Infantilism (?), *Cl. Rec.*, 300
Wrist, The Treatment of Disabilities of the Hand and (W. Cochrane), 97

YOUNG, JAMES, Further Study of an Organism Obtained from Cancerous Growths, *Obst.*, 110

PRINTED BY OLIVER AND BOYD, EDINBURGH

332.

R
31
E22
ser.3
v.28-29

Edinburgh medical journal

Biological
& Medical
Serials

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

STORAGE